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Edition 2 | 2002

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MINING METALLURGY MATERIALS



Magazine of the University of Leoben

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Annual Report 2001

Special Edition

Teaching:
40 % more first-year
students

page 10



Research:
Projects for
solutions

page 15

Cooperations:
New impetus for
economy

page 29



MONTANUNIVERSITÄT
LEOBEN
Franz-Josef-Strasse 18, A-8700 Leoben, Austria
Tel. +43 (0)3842 402-0 Fax +43 (0)3842 402-308

This special edition of the magazine of the University of Leoben presents the Annual Report 2001 with all information about teaching, research, cooperations, events and particulars.
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 www.unileoben.ac.at

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Rector Dr. Wolfgang Pöhl

Text:

Prof. Dr. Harald Harmuth,
 Margit Keshmiri, 1st Vicerector
 Dr. Abert Kneissl, Prof. Dr.
 Friedemar Kuchar, Dr. Tanja
 Lube, Prof. Dr. Reinhold W.
 Lang, Prof. Dr. Gü nter
 Langecker, Dipl.-Ing. Paul
 Mayrhofer, Prof. Dr. Peter
 Moser, Dipl.-Ing. Johannes
 Novak, Prof. Dr. Peter
 Paschen, Rector Dr. Wolfgang
 Pöhl, Dipl.-Ing. Markus
 Philipp, Prof. Dr. Johann
 Raith, 2nd Vicerector Prof. Dr.
 Brigitte Weinhardt, Mag.
 Thomas Winkler

Translation:

Mag. Cornelia Praschag (Study
 Abroad Center)

Layout:

Mag. Thomas Winkler (Public
 Relations Office)

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Department of Automation,
 Department of Ceramics,
 Department of Geosciences –
 Mineralogy and Petrology,
 Department of Mining
 Engineering, Department of
 Nonferrous Metallurgy,
 Department of Materials
 Science and Testing of Plastics,
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Clear Profile for

The year 2001 saw a series of changes which like an ignition spark exert sustainable influence on choosing the right direction in the university sector.

For the University of Leoben the year 2001 revealed that due to the strategy of the university, passed in November 2000, the university has developed a clear profile. Now we are in a position to specify a perennial budget based on the strategic projects.

The strategy of the University of Leoben mainly concentrates on the orientation of the "3 M": the core competencies Mining, Metallurgy, Materials - those core areas of the university which are not only restructured but also seen as a commitment for the extension of the value-added chain according to the expectations and demands of industry. The extension and the development of these three core competencies proceeded speedily. The increasing cooperation of the departments in interdisciplinary research projects can be seen as an essential potency of the university, which further increased our research capacity and competency.

The strategy paper could really be seen as a template for life. A whole series of projects are in the stage of implementation which initiated the structural changes in the field of the 3 M's. Two chairs were rededicated within the human resources of the university itself, one for information technology and one for drilling engineering and production well technology in the field of mineral raw materials and geo-technology. Another chair for the field of modeling and simulation of metallurgic processes could be dedicated with the support of industry for two years. The readiness for changes is enormous among the university members. In seven years four chairs will be rededicated and seven new chairs in total will be dedicated. Without the readiness of all university members and without the industrial and ministerial support this development certainly cannot happen. The university is getting ready for another competence center besides the Materials



Foto Freisinger

Future Development

Center Leoben. In early January 2002 Leoben was awarded the contract for the "Polymer Competence Center" (PCCL). We hope that the establishment of this competence center will finally lead to additional space for the departments of plastic engineering and automation, the application was already filed in 1993.

There was a lot of excitement when the tuition fees were introduced, but this affected the administration more than the students. The tuition fees also readjusted our statistics. In total there were 7% less students registered than in the year before but fortunately there were 40% more first year-students. Compared to other Austrian universities the University of Leoben is the one with the highest increase of first-year students. The statistics also shows that 12 semesters can be estimated as the average study time for regular students. However, the concerns about students for technical fields of study are justified because the potential of high school graduates interested in natural sciences and engineering is diminishing. In addition this potential has to be shared with the "Fachhochschulen" (universities for applied sciences). Therefore we have made enormous efforts this year to raise the interest and curiosity in technical subjects and the university itself among the up-and-coming academic generation in the schools. Additionally we tried to prove the higher value of a university compared to a "Fachhochschule" to the interested pupils.

The Practice Check was a very special success. At this point we would like to express our gratitude to all our sponsors. This initiative helped us, due to the strong impact on media, to raise enough interest in the University of Leoben. In

total 596 Practice Checks for students were financed by sponsors. Each Practice Check is worth 365 Euro - in total 217,540 Euro. Regardless of the social background each student receives a Practice Check for the first semester. Beginning with the second semester performance criteria have to be met. This initiative was also supported by banks which financed the value of the checks in advance.

The announced new University Act 2002, which will lead the universities into autonomy, requires a clear profile of the universities, which can be seen in the strategy of the relevant university. We have this profile and expect to be supported in our activities respectively. This support - for the further development of the strategic fields of knowledge along the value-added chain - cannot only come from industry. The University Act needs flexibility so that the universities are not paralyzed in their development. The University of Leoben is ready to sign service level agreements with the Federal Ministry of Education, Science and Culture.

Student exchange with our partner universities has developed very positively - especially with the Colorado School of Mines (CSM). An agreement was signed concerning the option for a double degree - Master of Science and Diplomingenieur - for students of the University of Leoben and for students of CSM with the defense of just one thesis.



*Berggrat h.c. Dipl.-Ing. Dr. Wolfgang Pöhl
Rector*

"The announced new University Act 2002 requires a clear profile of the universities. We have this profile and expect to be supported in our activities respectively."

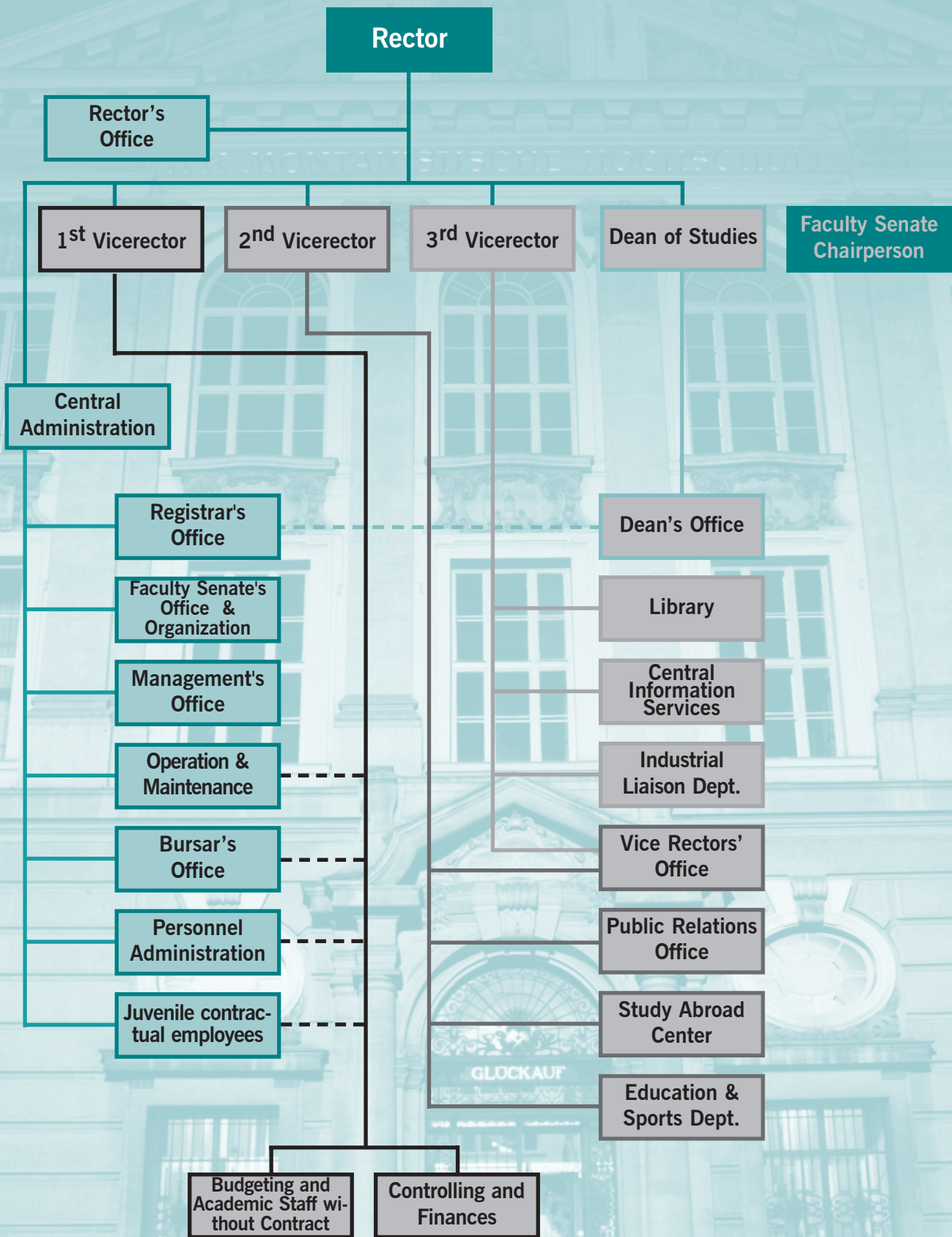
Management



*Management Group (f.l.t.r.):
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Dean of Studies Imrich
1st Vice Rector Kneissl
Rector Pöhl
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- Dean of Studies:** O.Univ.-Prof. Dipl.-Ing. Dr.techn. Wolfhard WEGSCHEIDER
(until November 2001)
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- 1st Vice Dean:** O.Univ.-Prof. Mag. et Dr.rer.nat. Robert DANZER
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- Employment Committee Chairperson (staff):** Amtsrat Helmuth TSCHOGGL
- Student Union Chairperson:** Florian STEINHART (until April 2001)
Bernd LINZER (after May 2001)
- Working Committee on Equal Treatment Chairperson:** Dipl.-Ing. Dr.mont. Tanja LUBE
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Mag. Dipl.-Ing. Dr.mont. Rudolf WÜSTRICH †

Organization



Unprecedented

The PracticeCheck campaign as a reimbursement for the new tuition fees turned out to be a great success. Sponsors supported the students of the academic year 2001/02 with checks.

The PracticeCheck combines practical work experience, mandatory for all degree programs, with the financing of the tuition fees.

The University of Leoben started an unprecedented campaign to cushion the impact of the tuition fees introduced in the winter semester 2001/02. Companies and institutions, for which it is of great interest that the University of Leoben produces as many graduates as needed, were asked to support this campaign.

The result was remarkable and unique. Companies, institutions and even private persons made 591 checks of roughly 218,000 Euro in total available for students in the academic year 2001/02.

The PracticeCheck is unbureaucratic, flexible and individually applicable, it combines practical work experience, mandatory for all degree programs, with the financing of the tuition fees. Practical work experience is an essential part of the education. Six months in total are obligatory for the diploma examination. The PracticeCheck is therefore linked to at least 2 weeks of practical work for which the students will receive 365 in addition to the regular payment.

Many thanks to all sponsors!

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- 10 SAG
- 10 Schlumberger GmbH
- 10 Verband Leobener Kunststofftechniker
- 8 Institut für Geowissenschaften, Univ.Prof. Dr. J. Wolfbauer
- 8 RAG
- 8 Weatherford Oil Tool GmbH
- 6 Dr. Hellmut Longin, Vorsitzender des Universitätsbeirates

Activity

6	Lafarge Centre Technique Europe Central	2	Rektor Dr. Wolfgang Pöhl
6	Lafarge Perlmooser AG, Wien	2	Rosendahl Maschinen GmbH
6	Univ.-Prof. Dr. Dr.h.c. F. Jeglitsch, Institut für Metallkunde und Werkstoffprüfung an der Montanuniversität	2	SML Maschinengesellschaft m.b.H.
5	Bank für Kärnten und Steiermark	2	Sparkasse der Stadt Leoben
5	Inteco GmbH	2	Stahl Judenburg GmbH
5	Österreichische Heraklith GmbH Fürnitz	2	Univ.-Prof. Dr. G. Langecker, Institut für Kunststoffverarbeitung an der Montanuniversität
4	AT&S AG	2	Univ.-Prof. Dr. H. Wagner, Institut für Bergbaukunde an der Montanuniversität
4	Marienhütte GesmbH	2	Univ.-Prof. Dr. K. E. Lorber, Institut für Entsorgungs- und Deponietechnik an der Montanuniversität
4	Philips Haushaltsgerätekwerk Klagenfurt	2	Univ.-Prof. Dr. K. Lederer, Institut für Chemie der Kunststoffe an der Montanuniversität
4	Schoeller Bleckmann Edelstahlrohr AG	2	Univ.-Prof. Dr. P. Fratzl, Institut für Metallphysik an der Montanuniversität
4	Treibacher Industrie AG	2	Univ.-Prof. Dr. R. Danzer, Institut für Struktur- und Funktionskeramik an der Montanuniversität
4	Univ.-Prof. Dr. Wilfried Krieger	2	Univ.-Prof. Dr. R. Lang, Institut für Werkstoffkunde und -prüfung der Kunststoffe an der Montanuniversität
4	Wietersdorfer & Peggauer Zementwerke GmbH	2	Univ.-Prof. Dr. Z. Heinemann, Institut für Erdöl- und Erdgasgewinnung an der Montanuniversität
4	Ziviltechnikerbüro "Die Markscheider", Dipl.-Ing. Emmerich Schuscha, Leoben	2	Univ.-Prof. Dr. P. O'Leary, Institut für Automation an der Montanuniversität
3	Bank Austria AG Leoben	2	Verein der Leobener Werkstoffwissenschaftler
3	Cincinnati Extrusion GmbH	2	VOEST ALPINE Bergtechnik GesmbH
3	ECONOMOS AUSTRIA GmbH	1	Compact-Druck, Bruck/Mur
3	Engel Maschinenbau GesmbH	1	Dipl.-Ing. Kurt Ernst
3	Fachverband der Gießerei-Industrie Wien	1	Druckerei Scharmer, Feldbach
3	Geberit Produktions GmbH	1	em. Univ.-Prof. Dr. Günter B. Fettweis
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3	MIBA AG	1	EMS-Grivory
3	Plansee AG	1	Fachverband Bergbau-Stahl
3	Theysohn Extrusionstechnik	1	Funder Industrie GmbH
3	Wirtschaftskammer Kärnten	1	Harald Tischhardt, Stadtrat Leoben
2	2. Landeshauptmann-Stv. Dipl.-Ing. Leopold Schöggl	1	IBS Austria GmbH Teufenbach
2	AEV	1	ISOVOLTA AG
2	Andritz AG-Umwelt und Prozeßtechnik	1	Pipeline Austria GmbH & Co KG
2	Bergmännischer Verband Österreichs	1	Raiffeisenbank Leoben
2	Brauerei Puntigamer	1	Reicher Feuerungs- & Schornsteinbau
2	buntmetall amstetten Ges.m.b.H.	1	Saubermacher Dienstleistungs AG
2	Corps Schacht	1	Siemens AG Österreich
2	Dipl.-Ing. Wolfram Mosser, Geschäftsführer der Fa. Brandner & Co. KG, Wallsee	1	Treibacher Auermet Produktionsges.m.b.H.
2	FCI Austria GmbH	1	Universal Druckerei Leoben
2	Gmundner Zement Produktions- und Handels GmbH	1	Winterthur Technologie GmbH
2	Gösser Brauerei	1	Wolfram Bergbau- und Hütten GmbH
2	Head Sport AG		Nfg KG
2	Institut für Markscheide- und Bergschadenkunde an der Montanuniversität		
2	Keller Grundbau Ges.m.b.H.		
2	LUZENAC NAINTSCH Graz-Andritz		
2	M. Klarmann, Arkadenhof Leoben		
2	max.mobil Telekommunikation Service GmbH		
2	Omya GmbH		
2	Philips Semiconductors Gratkorn		
2	PM Lucas Enterprises Ltd.		

Alma Mater

An increase of 40 % more first-year students as well as numerous graduations mark the statistics.

NUMBER OF FIRST-YEAR STUDENTS PER DEGREE PROGRAM						
Field of study	YEAR 1999		YEAR 2000		YEAR 2001	
	Men/ Women	Total	Men/ Women	Total	Men/ Women	Total
Mining Engineering	8 / 1	9	4 / 2	6	3 / 1	4
Mine Surveying	4 / 0	4	2 / 1	3	2 / 0	2
Petroleum Engineering	30 / 7	37	-	-	-	-
Petroleum Engineering (ISP)	26 / 5	31	20 / 2	22	24 / 6	30
Metallurgy	15 / 2	17	25 / 1	26	18 / 4	22
Ceramics	12 / 4	16	3 / 10	13	1 / 5	6
Mechanical Engineering	14 / 2	16	6 / 1	7	14 / 1	15
Materials Science	30 / 8	38	16 / 5	21	36 / 5	42
Plastic Engineering	26 / 8	34	12 / 5	17	37 / 5	42
Applied Geosciences	11 / 6	17	2 / 4	6	15 / 15	30
Industrial Environm. Protection	23 / 21	44	22 / 14	36	27 / 18	45
TOTAL	199 / 64	263	112 / 45	157	177 / 61	238
Percentage of women		25		29		26

CHART 1: number of first-year students according to degree programs (without preparatory year, qualifying date: end of registration period of the academic year)

In comparison to the previous year there were 40% more first year students at the beginning of the academic year 2001/2002 – an increase despite the introduction of tuition fees in Austria and contrary to the nationwide trend (see chart 1).

In a survey first-year students listed vocational and educational fairs as well as teachers as their primary source of information (see chart 3). The homepage of the University of Leoben was ranked fourth, which indicates that communication via "new media" gains more and more importance for information gathering.

The interest in the field of studies, the excellent carrier prospects of the graduates and an aversion against "mass universities" are the three most frequently named reasons for a decision for the University of Leoben (see chart 6). The career chances and the chance to find an interesting job therefore seem to be the most important expectations of the first-year students (see chart 7).

According to first year students studying at the University of Leoben is thought to be difficult. Since the introduction of the first year of study, which is the same for all students regardless of their field of studies, in 1997, differences in the educa-

REGULAR DEGREE STUDIES AT THE UNIVERSITY OF LOEBEN

	YEAR 1999		YEAR 2000		YEAR 2001	
	Men/ Women	Total	Men/ Women	Total	Men/ Women	Total
Number	2365 464	2829	2197 464	2661	1991 480	2471
Percentage of women:		16		18		19

CHART 2: number of enrolments including doctorates, individual diploma programs (without preparatory year, qualifying date: end of registration period of the academic year)

SOURCES OF INFORMATION ABOUT THE UNIVERSITY OF LOEBEN

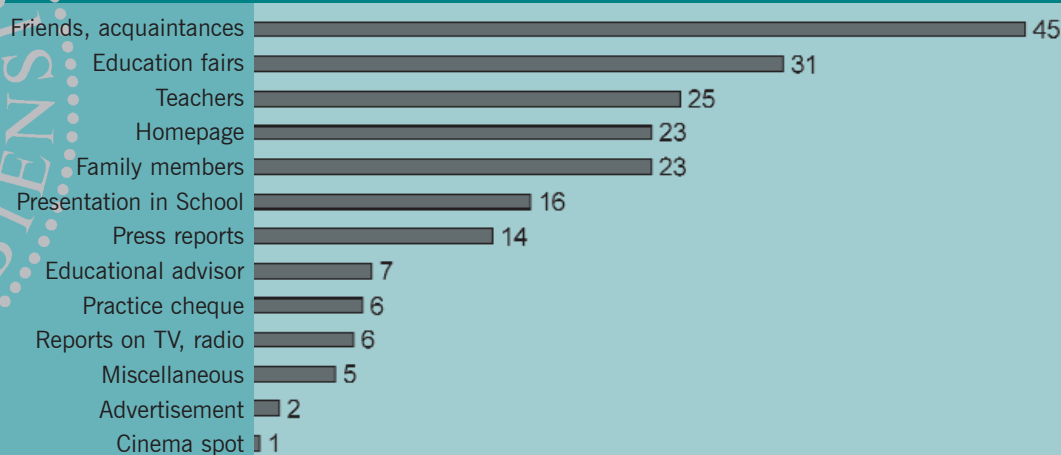


CHART 3: Survey of first-year students in winter semester 2001/2002
In % with three possible options

tional level in the basic subjects mathematics, chemistry and physics can be evened out - which in the future will lead to shorter study times.

Asked, why their friends did not start to study in Leoben, the students named the generally little interest in technical fields of studies as well as the missing attractiveness of "small town" Leoben as the reasons.

The number of graduates is also very satisfying. With 199 graduations and 25 doctoral degrees the university could bring in a very good harvest of up-and-coming academics.

The decline of the number of registered students by 7 percent is a result of the introduction of tuition fees. The percentage of women, however, increased by 1 percent. The efforts to interest also young women in a technical field of studies are bearing fruit.

The percentage of foreign students has increased significantly to 17 percent at the moment. The foreign students come from 50 nations from all over the world, most students come from non-EU countries. The figures demonstrate that the University of Leoben is also an international community of students.

Further Statistics

GRADUATIONS PER DEGREE PROGRAM

Field of study	YEAR 1999		YEAR 2000		YEAR 2001	
	Men/ Women	Total	Men/ Women	Total	Men/ Women	Total
Mining Engineering	4 / 0	4	9 / 0	9	7 / 1	8
Mine Surveying	1 / 0	1	1 / 1	2	2 / 0	2
Petroleum Engineering	18 / 1	19	11 / 0	11	14 / 1	15
Petroleum Engineering (ISP)	5 / 0	5	7 / 0	7	14 / 0	14
Metallurgy	17 / 0	17	12 / 0	12	7 / 3	10
Ceramics	5 / 0	5	5 / 1	6	4 / 0	4
Mechanical Engineering	8 / 0	8	8 / 0	8	8 / 0	8
Materials Science	46 / 5	51	32 / 0	32	34 / 3	37
Plastic Engineering	28 / 3	31	28 / 3	31	15 / 4	19
Applied Geosciences	14 / 3	17	8 / 6	14	10 / 1	11
Industrial Environmental Protection	40 / 5	45	55 / 14	69	62 / 9	71
Other (individual diploma study, petroleum geology etc)	-	-	-	-	-	-
TOTAL:	181 / 17	198	176 / 25	201	177 / 22	199
Percentage of women		9		12		11

CHART 4: number of graduations according to fields of study (period: 1.1. to 31.12. of the calendar year)

DOCTORATES

	YEAR 1999		YEAR 2000		YEAR 2001	
	Men	Women	Men	Women	Men	Women
Women						
Austrians	24	2	21	0	21	2
Foreign students	9	1	3	1	1	1
TOTAL:	36	3	25	1	25	3

CHART 5: number of doctorates of Austrian und foreign students (period: 1.1. to 31.12. of the calendar year)

MAIN REASONS FOR STUDYING AT LEOBEN

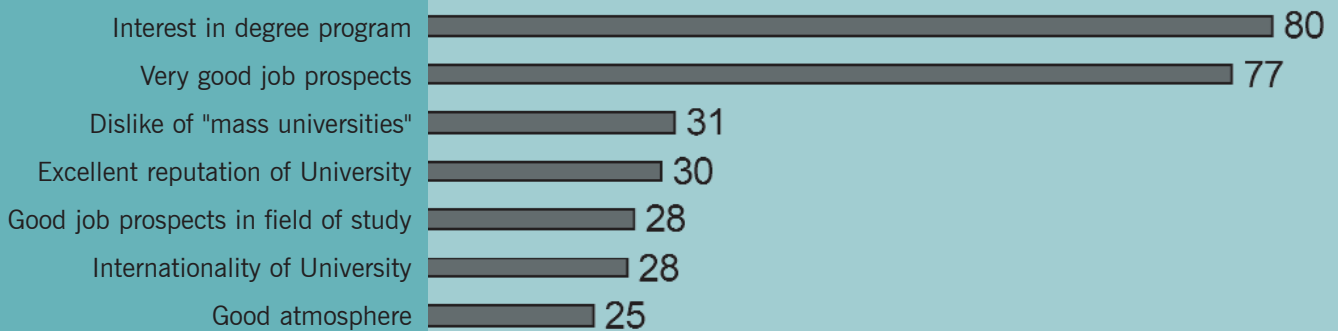


CHART 6: Survey of first-year students in winter semester 2001/2002. In % with three possible options

EXPECTATIONS AFTER GRADUATION

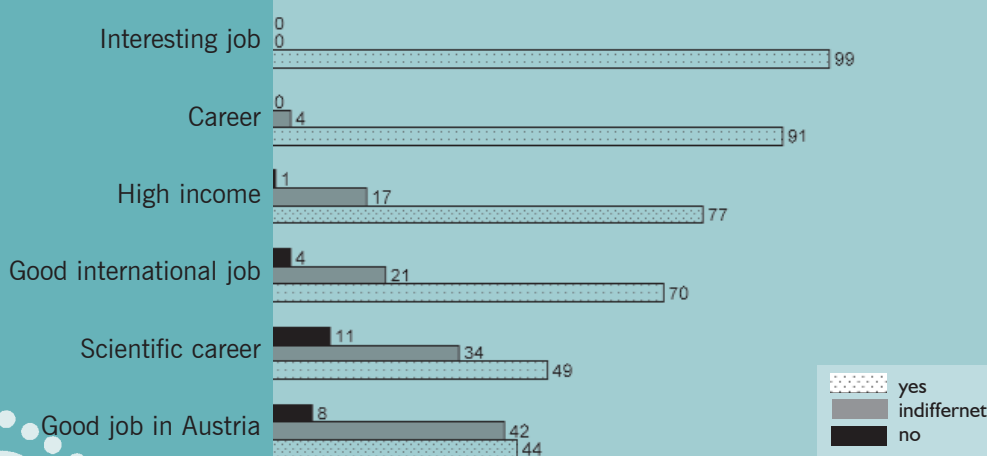


CHART 7: Survey of first-year students in winter semester 2001/2002
In % with three possible options

MAIN REASONS FOR THE INHIBITION TO STUDY AT LEOBEN

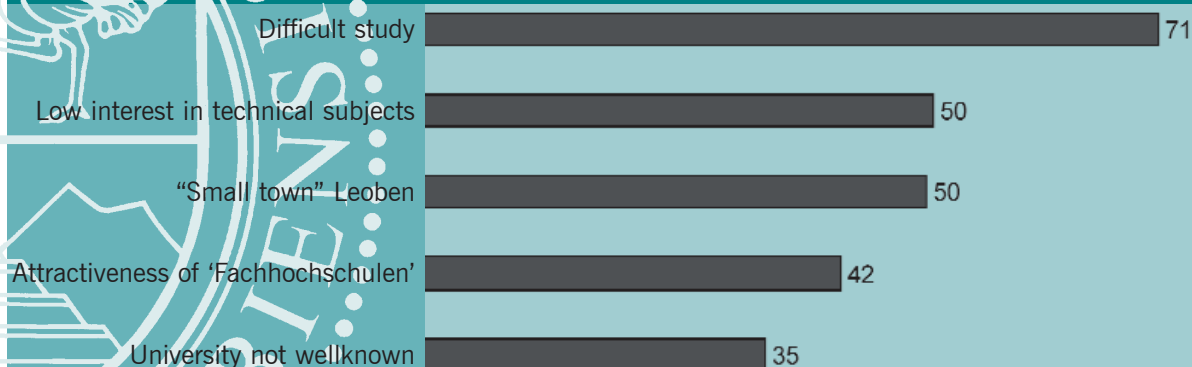


CHART 8: Survey of first-year students in winter semester 2001/2002
In % with three possible options

PERCENTAGE OF FOREIGN STUDENTS AT REGULAR DEGREE STUDIES

	YEAR 1999	YEAR 2000	YEAR 2001
EU-countries	78	73	34
Non-EU-countries	176	183	275
TOTAL	254	256	309
%	9	10	17

CHART 9: number of inscriptions of foreign students
(without preparatory year, qualifying date: end of registration period of the academic year)

PLACES OF ORIGIN OF THE AUSTRIAN FRESHMEN

Numbers in %	YEAR 1999	YEAR 2000	YEAR 2001
Styria	51	57	52
Lower Austria	12	7	8
Upper Austria	12	15	13
Carinthia	13	5	10
Vienna	4	3	2
Burgenland	3	3	6
Salzburg	3	6	4
Tyrol	1	2	3
Vorarlberg	1	1	1

CHART 10: Distribution of freshman according to provinces
(Source: internal questionnaire at registration)

Life-Long Learning

In the year 2001 the continuing education program of the University of Leoben included lectures, workshops and 4 university courses.

CONTINUING EDUCATION PROGRAM OF THE DEPARTMENTS/SERVICE SECTOR

Type	Quality Assurance in Chemical Labs University course
Organization	Department of General and Analytical Chemistry
Location	University of Leoben
Duration	July 9-13 and September 20
Type	Environmental, Quality and Generic Management 3 university courses, degree: Academic Quality Manager, Academic Environmental Manager and Master of Advanced Studies in Generic Management
Organization	Department of Economics and Business Management, Department of Waste Management and Landfill Technologies (Environmental Management)
Location	University of Leoben
Duration	3 respectively 4 semesters, blocked course
Type	TPM- Coach Continuing education seminar, degree: TPM coach certificate
Organization	Department of Economics and Business Management
Location	University of Leoben
Duration	March 14-17, 2001
Type	Investment Management Insta live Workshop
Organization	Department of Economics and Business Management
Location	University of Leoben, RHI Trieben
Duration	November 12-13, 2001
Type	TQM- Manager Seminar, degree: Certified TQM-Manager
Organization	Department of Economics and Business Management
Location	University of Leoben
Duration	Blocked course, 1 semester
Type	Environmental Manager Seminar, degree: Certified Environmental Manager
Organization	Department of Economics and Business Management
Location	University of Leoben
Duration	Blocked course, 1 semester
Type	Service Agreements Workshop for the Federal Ministry of Education, Science and Culture
Organization	Prof. Dr. Hubert Biedermann, Department of Economics and Business Management University of Leoben Prof. Dr. Franz Strehl, Department of University Law and Management, University Linz
Location	Vienna
Duration	December 11 and 13, 2001
Type	Environmental Management for Environmental Representatives of OEGB University course
Organization	Department of Waste Management and Landfill Technologies
Location	WIFI Linz
Duration	May 29-30, 2001
Type	Quality Assurance in Labs University course
Organization	Department of Waste Management and Landfill Technologies
Location	University of Leoben
Duration	June 9-14, 2001

CONTINUING EDUCATION PROGRAM OF THE DEPARTMENTS/SERVICE SECTOR

Type	Kick-Off Meeting to EU-Contract No. QLK5-CT-2001-0401
Organization	"Innovative models of critical key indicators as planning and decision support for sustainable rural development and integrated cross border regional management in former Iron Curtain areas based on north to south European reference studies"
Location	Department of Technical Ecosystem Analysis
Duration	Mayerling, November 8-11, 2001
Type	EU-Project-Submission "Integrated Water Management Approach - Essentials for Sustainable Development of Island Catchments and Their Continental Implications (INWAMA)"
Organization	Workshop
Location	Department of Technical Ecosystem Analysis
Duration	Vienna September 28-30, 2001
Type	Selected Chapters of General, Analytical and Physical Chemistry
Organization	Seminar
Location	Department of Physical Chemistry and Department of General and Analytical Chemistry
Duration	University of Leoben Academic year 2001
Type	Tutorials
Organization	Department of Electrical Engineering
Location	University of Leoben
Duration	August 25-26, 2001
Type	2 Tutorials in the Framework of the 9th European Conference on Power Electronics and Applications
Organization	Department of Electrical Engineering
Location	Blumau
Duration	August 26, 2001
Type	Materials Science and Tool Technological, Process Engineering, Machine Technological Fundamentals of Injection Molding for Mahle Filtersystems, Carynthia
Organization	Department of Plastics Processing
Location	University of Leoben
Duration	February 8-9, 2001 and February 15-16, 2001
Type	Blasting Engineering
Organization	University course
Location	Department of Mining Engineering
Duration	University of Leoben March 19-28, 2001
Type	Refractory Metals
Organization	10 hour course in English
Location	Department of Nonferrous Metallurgy
Duration	TU Delft, Netherlands May 2001
Type	Sustainable Development in Metallurgy
Organization	10 hour course in English
Location	Department of Nonferrous Metallurgy
Duration	TU Delft, Netherlands June 2001
Type	MCL-School on Phase Transformation Kinetics
Organization	Postgraduate course
Location	Department of Mechanical Engineering
Duration	Materials Center Leoben June 5-6, 2001
Type	Course on Mechanics of Advanced Materials MAM 2001
Organization	Postgraduate course
Location	Department of Mechanics
Duration	Institute of Fundamental Technological Research (IFTR), Polish Academy of Sciences, Warsaw, Poland October 8-12, 2001

Projects for Solutions

The majority of the research projects are implementation-oriented in their approach. Especially in the core areas "Mining, Metallurgy, Materials" the University of Leoben demonstrates excellent research competencies.



The number of research projects, which were finished within the framework of the partial legal capacity of the departments in 2001, is listed in the table below. In total the income raised from third party funding amounts to 7.5 million Euro. The year 2001 has been even more successful than the year 2000 (roughly \square 7 million). The result of the year 2001 is also noticeably higher than the average of the years 1999 to 2001 with \square 6.8 million.

The presentation of all projects carried out in 2001 would go beyond the scope of this report. The following presentation of some projects does not diminish the scientific importance of the others at all. This year's selection of 10 project wants to prove that:

1. With the new "Triple-M" strategy the

University of Leoben intends a consequent further development of the core areas "Mining, Metallurgy and Materials" to achieve international competitiveness and acceptance.

2. Cooperation with industry is of crucial importance which is demonstrated by several Christian-Doppler-Laboratories, the Materials Center Leoben, FFF-projects and direct projects with companies. Fundamental research as a basis for applied research and for technical innovations also plays an essential role.

3. Scientific research mainly focuses on the three core areas. Important contributions are made to research in bio-materials, in medical, semi-conductor and simulation technologies in the sense of multidisciplinary and increased competence.

RESEARCH PROJECTS AT UNIVERSITY OF LOEBEN COMPLETED IN THE YEAR 2001

Type of the project	EU	FWF	FFF	Christian-Doppler-Laboratories	Federal Government, provinces, communities	Other customers/sponsors
Number	6	8	13	16	39	278

Total: 397

EU: European Union
FWF: Austrian Science Fund (Fonds zur Förderung der wissenschaftlichen Forschung)
FFF: Industrial Research Promotion Fund (Forschungsförderungsfonds für die gewerbliche Wirtschaft)

Precise Ore Dating

The Department of Geosciences, Mineralogy and Petrology, improved dating techniques for scheelite.

Strata-bound scheelite deposits such as the currently mined Felbertal deposit, province of Salzburg, are the major tungsten resources world-wide. Though intensely studied, their genesis is still debated, mainly because of insufficient knowledge of the timing of ore formation. So far only the host rocks of the ore and not the ore itself could be dated.

Re-Os method

The Re-Os method is based on the radioactive decay of ^{187}Re to ^{187}Os . It allows precise and direct dating of ore minerals that contain small amounts of rhenium (e.g. the Mo-sulphide molybdenite or the Ca-wolframate scheelite).

The aims of this project, which is financed by the Austrian Science Fund (FWF) are:

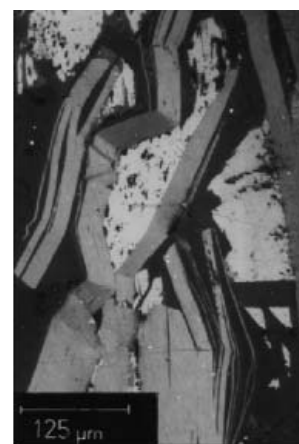
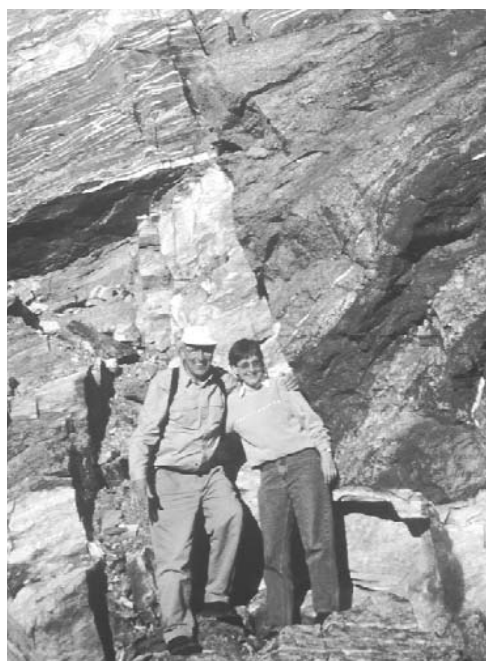
- (a) Direct dating of the Felbertal scheelite and abandoned Alpeinerscharte molybdenite deposits with the Re-Os chronometer. In addition to dating molybdenites, strong emphasis will be placed on improving dating techniques for scheelite.
- (b) Clarifying the genesis of the Felbertal deposit and developing a genetic model for W and Mo mineralisation in the Hohe Tauern area.

Partners from co-operating institutions during field work at the abandoned open pit in the Eastern Ore Field. Prof. R. Höll (left) who discovered the Felbertal scheelite deposit and Dr H. Stein (right), Director of the AIRIE Programme
(Photo: Department of Geosciences, Mineralogy and Petrology)

(c) Testing the robustness of the Re-Os system in molybdenite and scheelite with respect to regional metamorphism. Results of this project will also be important for the mining industry, as they will help to develop better exploration strategies.

Co-operation with CSM, USA

The project is part of the GEODE (Geodynamics and Ore Deposit Evolution) program, which is supported by the European Science Foundation (ESF). The project is in co-operation with the AIRIE (Applied Isotope Research for Industry and the Environment) Group, Colorado State University, USA, where the Re-Os isotope analyses will be done; the FWF is financing a one-year academic position at this institution. Prof. R. Höll, University of Munich, is another co-operation partner.



Molybdenite (deformed) - native bismuth intergrowths. Reflected light microscopy image.
(Photo: Department of Geosciences, Mineralogy and Petrology)

Underground openings

The aim of the FWF-research project 'Development of a methodology for the dimensioning of large mining excavations' is to develop a dimensioning model for permanent mining excavations and rock pillars for massive alpine mineral deposits.

The increasing sensitivity of society to environmental issues and the exhaustion of mineral deposits which are close to the surface leads to an increasing tendency towards the underground extraction of minerals and in particular industrial minerals. The two demands on the mining system are to keep the cost of mining within the typical range of surface mining costs and to ensure that the mining activities do not affect the surface. From the point of view of the national economy the mineral deposits should be exploited as completely as is possible.

Cost reasons

For cost reasons it is desirable to excavate large production excavations and leave small pillars. In contrast the requirements of safety and the protection of the surface are better met by small mining excavations and large pillars.

Out of these contrasting requirements the demand results for a methodology for the dimensioning of underground mining excavations and pillars.

Over the past 3 years a considerable amount of data on pillar conditions in various international mines has been collected. In each mine different mining areas were investigated. A combination of subjective, empirical, numerical and geophysical methods was applied.

Classical methods were used for the de-

scription of the rock mass and for evaluation of geomechanical parameters of the In-Situ rock. Based on empirical equations the pillar strengths were estimated. More than 2500 p-wave measurements were carried out in the laboratory. These were complemented by 2000 In-Situ measurements. Additionally 300 m of drill holes were scanned for examination of existing cracks and joint sets by using a bore hole camera. A detailed geological investigation of the areas was carried out. Additionally to these In-Situ surveys a large number of laboratory strength tests were done. Also the dynamic and static moduli of elasticity of these samples were determined. All these data were stored in a central database.

Different numerical models

For most areas a good agreement between the geophysical, geological, empirical data and the subjective observation was found. Based on these data the input parameter for numerical calculations of the rock mass have been estimated. Different numerical models were run to compare the calculated results to the observation in the mine. Based on these experiences a methodology for the description of the pillar condition has been developed.

Using this methodology it is possible to:

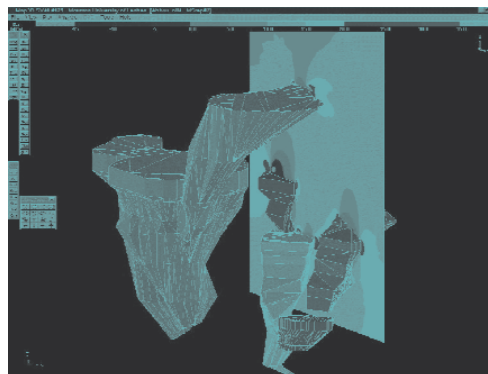
- Indicate areas/pillars with different mechanical behavior
- Indicate areas/pillars with different strength capacity
- Detect and document a change in the strength capacity of a special pillar over the time
- Identify areas/pillars with potential rock mechanic problems

Based on this methodology it was possible to assess mine stability and to recommend remedial actions.



*The projects combines empirical, numerical and geophysical methods
(Photo: Mining Engineering Department)*

*Different numerical models were run to compare the calculated results to the observation in the mine
(Photo: Mining Engineering Department)*



Better and cheaper lined

A project of the Department of Ceramics helps to save costs and improve security of refractory linings by computer modelling.

Modern steel production is a state-of-the-art process realised in a sequence of special furnaces and vessels. To sustain the high temperatures of the liquid steel and the aggressive nature of some components used in the process the furnaces are lined with special refractory ceramic materials. The reliable performance of the refractory materials is very important not only with respect to the feasibility of the process. A failure of the lining may result in a break out of the liquid steel endangering human lives and causing significant financial losses.

Cooperation with steel and refractories producers

Thermo-mechanical behavior of refractory materials and their structures was investigated by means of computer modelling at the Christian-Doppler Laboratory for Building Materials with Optimized Properties at the Department of Ceramics. This work is a result of cooperation with steel and refractories producers. The computer modelling allows a better understanding of the lining behavior by analyzing the influence of different structural and service parameters. Investigation of a steel converter illustrates the application of the method.

Stress reduction

The converter is a furnace where pig iron is transformed to steel by reducing the content of carbon. The lining of the converter is made of several layers of magnesia-carbon bricks. From the service experience it is known that the lining is prone to fail at the junction of the lining bottom and the wall. To establish the reason of the failure and to find measures to prevent it the converter lining has been

modelled by means of a finite-element analysis (FEA). Due to the cylindrical shape of the converter a model of a symmetrical segment of the lining is representative for the whole structure (fig. 1). Besides the refractory lining and the steel shell the model also features vertical and horizontal expansion gaps between the bricks which are introduced to reduce stresses caused by the temperature rise.

The analysis is conducted in two stages. First, the lining temperature is calculated, and the results of the thermal analysis are used in a second stage to compute stresses and possible material failure.

The analysis results show the possibility of crack formation in the transition zone between the bottom and the wall of the furnace. It helps to find measures to prevent this kind of failure, e.g. the optimum size and arrangement of expansion gaps, the lining design and the material selection. The investigations summarized above have successfully been applied by the Austrian steel industry in order to raise the lifecycle of refractories.

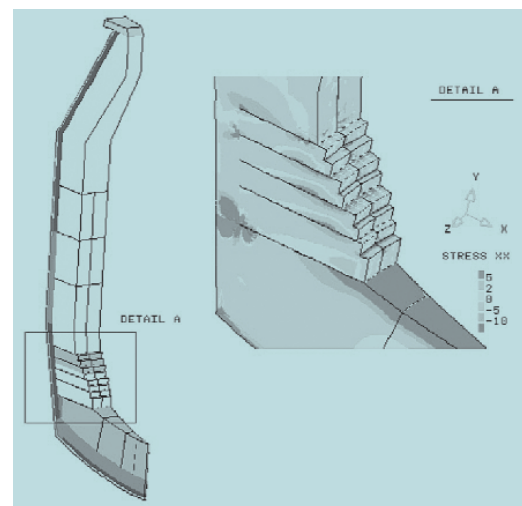


Fig. 1 Computer model of a converter lining, detail A shows the distribution of radial stresses (Illustration: Department of Ceramics)

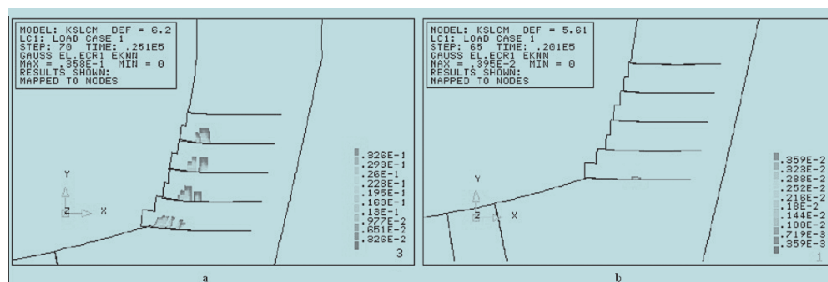
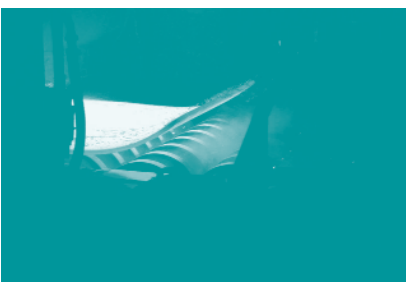


Fig. 2 Cracks in the bottom-wall transition zone a) can be avoided by properly designed expansion gaps b) (Illustration: Department of Ceramics)

Fit without warping & bending

Basic technologies for the avoidance of costly rolling defects were developed at the Department of Plastic Deformation and Plant Machinery and the voestalpine Grobblech GmbH.



*Bending in the production process
(Photo: Department of Plastic Deformation and Plant Machinery)*

Heavy plates - broad sheet steels thicker than 3 mm - are an important rolled-steel product for modern energy and transportation engineering as well as for innovative mechanical and plant engineering. Whether petroleum is extracted from the bottom of the sea on oil rigs, water, petroleum or gas has to be transported in large diameter pipes over long distances or "green" energy has to be utilized in the form of electricity, heavy plates are the most frequently used construction material. The production of this high-tech product confronts modern plant engineering with technical limits. Forces of the dimension of 100 MN (that is the weight force of 8350 middle class cars) and input torques of 6000 kNm (28000 times of the motor input torque of the same car category) occur. The exact knowledge of the production process and of the relevant influencing parameter assures a reproducible product quality.

Flat and straight

Extreme rolling conditions can cause rolling problems such as front end bending and warping whereby the plates bend upwards or downwards unexpectedly. In the case of warping one curvature closely follows the other along the length of the rolled products. Of course this bending during the rolling process is not intended, plates are supposed to be flat and straight.

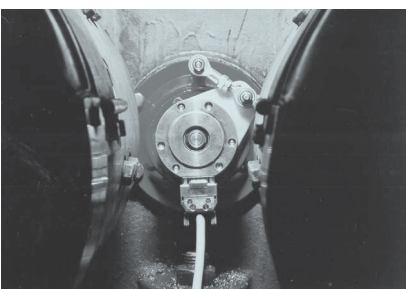
The voestalpine Grobblech GmbH and the Department of Plastic Deformation and Plant Machinery took up this problem together and examined it in the framework of a dissertation. Extensive operating measuring, which recorded the conditions during the production process, as well as time consuming mod-

eling of the rolling process by means of the finite element method (FEM) were necessary. Essential knowledge concerning the dependency of the front end bending and warping on process technological parameters such as the peripheral speed of the work rolls, the entrance thickness of the plates and the reduction per pass as well was gained by means of a close-to-reality simulation of the rolling process. Easily comprehensible knowledge such as the bending of the rolled product towards the slower rotating work roll under little shape factors could be confirmed and quantified.

At the same time also the intuitively hardly conceivable bending towards the faster rotating work roll under large shape factors could be computed and described. The resulting data were compiled in a database and can be applied for the process control. For the first time now plant managers can adjust rolling parameters so that these can counteract efficiently to warping and bending effects.

Additionally the essential influence of drive technology on warping and bending could be proved by coupling operating measuring data and simulation. The requirements for the operating behavior of the applied heavy duty drives could be formulated for the first time in order to avoid warping and bending.

The scientific findings in the framework of the dissertation contribute to a large scale modernization of the 4.2 m heavy plate mill at voestalpine Grobblech GmbH and promise not only an innovation of the production process but also a reproducible product quality of the promising construction material.



*Extensive operating measuring, which recorded conditions during the production process
(Photo: Department of Plastic Deformation and Plant Machinery)*

Stubborn metals – we tame you

The Department of Nonferrous Metallurgy is on the track of taming refractory metals.

Metals with melting points above 1700 °C are called "REFRACTORY METALS", e.g. vanadium, chromium, zirconium, niobium, molybdenum, tantalum, tungsten. "Refractory" – Latin for immune, hard-wearing – does not only mean that they are difficult to melt (3410 °C for Tungsten), but that they opposed to being treated metallurgically (oxydation, reduction a.s.o.) - "stubborn", like a mule.

The Department of Nonferrous Metallurgy has done research on most of the above mentioned metals in the last 10 years. This resulted in fruitful cooperations with the Austrian industry, which is very strongly positioned in this field – even seen internationally: Plansee AG (Reutte, Tyrol), Wolfram Bergbau- und Hüttenbetrieb GmbH (Bergla, Styria) and Treibacher Industrie AG (Treibach-Althofen, Carinthia). Very different metallurgical processes have been used and have been modified with respect to the user-specific demands: Selective pyrometallurgical reduction processes for vanadium, molybdenum, tantalum, electrolysis for chromium, doping of tungsten.

One has to act here rather cunningly, because these stubborn metals gasp heavily for oxygen, and – to be precise – for very different portions (different valencies as the chemists say).

At present we deal with the reduction of



niobium pentoxide Nb₂O₅ in a project with CBMM (Companhia Brasileira de Mineração e Metais, Araxá, Brazil, and Düsseldorf, Germany).

It works!

The present way of niobium reduction has many disadvantages: high energy consumption, high impurities' content, non ideal grain size, high costs. The oxide does not wish to get reduced (of course, following thermodynamics): "stubborn". To get a mule willing, you have to play tricks on him. That's exactly what we do: We muddle up gaseous and metallic reductants, temperatures, partial pressures, atmospheres, grain size to influence reaction kinetics and equilibria in a chaotic reactor. It works! The mule is tamed.

How? We are not allowed to tell you yet!

*No mules but rather stubborn refractory metals will be tamed.
(Photo: Department of Nonferrous Metallurgy)*

Thermal Stability

A new method was developed to investigate the thermal behavior of ultrahard, nanostructured coatings above 800°C. This was done at the Department of Physical Metallurgy and Materials Testing and the Materials Center Leoben within the framework of a project supported by the “Jubiläumsfonds der Oesterreichischen Nationalbank”

Over the last years thin film technology has been developed into a major part of industry. The research activities in coating development open a lot of possibilities to use tools in high-tech processes by applying optimized coatings. Magnetron sputtering is a deposition technique which is already industrially used for a variety of applications. As part of physical vapor deposition (PVD) techniques magnetron sputtering is preferentially used to deposit hard coatings, where structure, grain size, hardness and a lot of other properties can be adjusted by varying the deposition parameters.

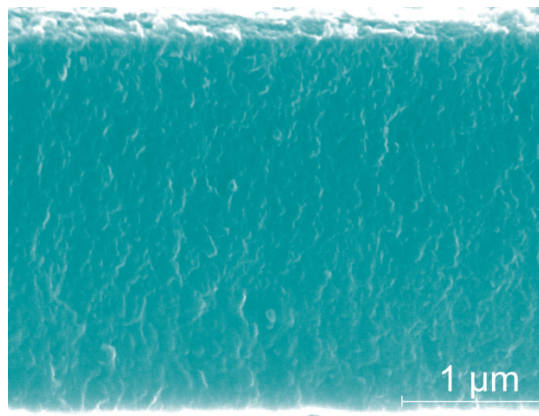
Hard coatings are not only known for their high hardness but also for their resistivity against wear and corrosion as well as their high thermal stability. To further improve the poor ductility of conventional hard coatings a lot of effort has been put into the development of nanostructured coatings. Those are primarily

used for high temperature applications. Consequently the failure mechanisms at high temperatures need to be known to further optimize coated tools and to gain fundamental knowledge for designing those coatings.

Differential Scanning Calorimetry (DSC) was used to determine exactly the recrystallization temperature of nanostructured hard coatings. With this method a sample is subjected to a temperature-time program. If there are phase transformations, chemical reactions, recovery and recrystallization processes (exothermic and endothermic) a temperature deviation to the inactive reference material is detected. Grain growth, which takes place after recrystallization of nanostructured coatings (grain size about 5 nm) can be quantified by this method. The driving force for this process is the reduction of the inner surface energy. Using different heating rates the activation energy of grain growth of nanocrystalline coatings can be determined by the Johnson-Mehl-Avrami equation and the Arrhenius relationship under certain conditions.

This work was an initiator for two new projects to develop functional coatings, which are supposed to show high protection as well as excellent tribological properties in a defined temperature range.

Differential Scanning Calorimetry (DSC) was used to determine exactly the recrystallization temperature of nanostructured hard coatings (Photos: Department of Physical Metallurgy and Materials Testing)



Material Testing Program

In a joint European research program coordinated by the Department of Structural and Functional Ceramics, a complete set of material properties is measured for a commercially available silicon nitride ceramic.

For more than thirty years high strength ceramics like silicon nitride, silicon carbide, zirconia and others for structural applications have been developed. World-wide efforts in the development of such ceramics resulted in greatly improved performance of these materials. Most materials now reach more than twice the strength measured in the 70's combined with a reduced scatter of strength and an increase in toughness. This achievement can be attributed to the availability of modern nanometer sized raw powders and the growing understanding of the interaction between the properties of the raw materials, the process technology and the microstructure. Today it is possible to produce materials with properties tailored for specific applications. Additionally, concepts for a reliable design of safe ceramic components were developed and are now established tools.

Several successful demonstrations of the suitability of ceramics for structural applications, e.g. as material for turbo charger rotors, were achieved as well as examples for material adapted design. Nevertheless a break-through in the use of structural ceramics did not yet take place. The most important reason for this, a significant lack of consistent design relevant data, e.g. strength and toughness but more significant on crack growth and fatigue, can be recognized.

In a joint European research program coordinated by the Institut für Struktur- und Funktionskeramik under the patronage of the European Structural Integrity Society (ESIS), a complete set of material properties indispensable for design (including crack growth parameters, cyclic fatigue data and data correlated to contact loading) was measured for a commercially available silicon nitride ceramic. It is expected that this program will result in a complete database for mechanical design for that material, be the basis

for detailed design studies, give a baseline for further material development, enhance the use of silicon nitride ceramics in structural applications, make a fair comparison between alternative materials possible and produce synergistic effects in future research in this class of materials.

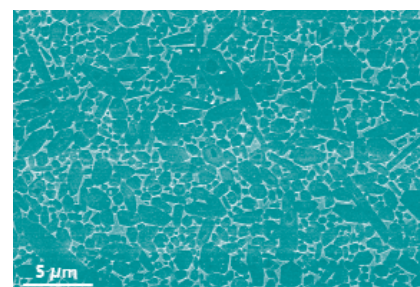
To establish a useful database, a material that performs reasonably in a large number of possible applications is chosen to ensure a fair comparison with alternative ceramics. It is a commercial silicon nitride made by a large European producer. The production has reached a stable quality and the existence of the material is assured for several more years.

16 laboratories from 9 countries

The aspired goal of providing a complete set of design data involves a huge experimental effort comprising state of the art standardized tests as well as highly sophisticated experiments requiring custom-made machinery. The work is organized in five topics which are coordinated by internationally renowned scientists. 16 laboratories from 9 European countries share the work in the project according to their expertise.

At present more than 1000 standard bend bars and other specimens have been produced and distributed. Strength, toughness, crack growth and elastic properties were determined at ambient and elevated temperatures. Wear properties were investigated to compare the material with competitors. Fatigue tests are in progress.

It is expected that the majority of tests will be finished by the end of 2003. The outcome of the 'Reference Material Testing Program' will be published and easily accessible in printed form but also via modern electronic means. To show the practical applicability of the gathered data, some design studies will be added to the data collection.



*Nanostructure of a high strength ceramic
(Photo: Department of Structural and Functional Ceramics)*

Flow Behavior

The Department of Plastics Processing want to start an interdisciplinary main research on Powder Injection Molding.

Powder injection molding (PIM) is a technology for the production of parts of metal or ceramic powders. This process allows considerably more complex components to be manufactured in comparison to conventional methods (e.g. compression molding).

The feedstock as an initial product for the injection molding of PIM green parts determines the quality of the sintered PIM-parts. The feedstock is a powder-binder-mixture in granular form.

In order to be able to control the filling process in a better way, it is necessary to determine the flow characteristics of the feedstock and to describe it with mathematical functions that can be used for computer simulation. Nowadays the determination of the flow characteristics occurs basically using MFI- and capillary-rheometric measurements. In the cases of the application of high pressure capillary rheometers often only apparent flow-curves are determined. For simulation processes these data are not useful. Furthermore, possible flow-anomalies are not recognizable by such measurements.

Therefore precise investigations on the flow behavior are carried out at the Department of Plastics Processing for standard feedstocks under special consideration of possible flow-anomalies. Slot die systems and the evaluating methods developed at the Department are applied for that.

The target of this project is the optimization of the feedstock-processing by means of injection molding in order to achieve low-distortion and faultless green parts.

Within the framework of preliminary investigations at the Department of

Plastics Processing the mold inserts for simple test specimens were constructed and built. For four simple part geometries (specimen for bending test, oblong plate with flow-obstacles, plate with angle and a gear) investigations on the demoldability and shrinkage were carried out. Moreover, three dimensional FEM-simulations of the form filling process were carried out with the measured material data. Figure 1 shows the green part of the gear made at the Department of Plastics Processing (molded part, 3D-geometry and section of the FEM--mesh). In figure 2 the simulation of the form filling process is represented and figure 3 illustrates the shrinkage of the green part (to the left) to the sintered final product (to the right).

European dimension

In Austria the main emphasis of investigation is supposed to be put on PIM. The Department of Plastics Processing Leoben together with the Materials Center Leoben, the Research Center Seibersdorf, the Department of Physical Metallurgy and Materials Testing as well as the Department of Structural and Functional Ceramics and the FH Wr. Neustadt in cooperation with enterprises of the plastics industry and material manufacturers are supposed to pursue interdisciplinary research.

Additionally, a research project on the subject of PIM within the framework of an EU-CRAFT-project of the Department of Plastics Processing Leoben with the Fraunhofer Institute for Manufacturing and Advanced Materials Bonding Technology and Surfaces Department (IFAM) in Germany is under preparation, which shows the European dimension of this technology.

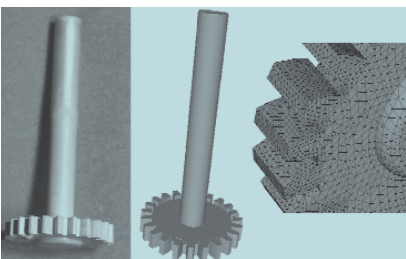


Figure 1: Injection-molded metal powder gear, 3D-model, mesh (Photos: Department of Plastics Processing)

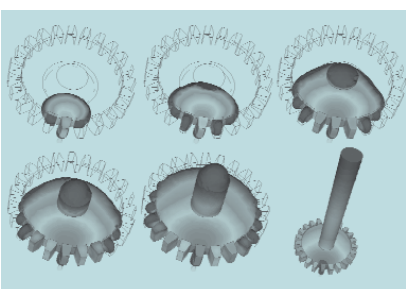


Figure 2: 3D-filling simulation of the gear (flow-front at different filling-times)

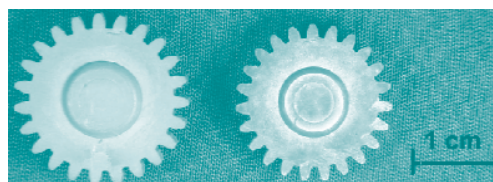


Figure 3: Shrinkage: Green part (to the left), sintered final product (to the right)

Deformation Behavior

The long-term deformation behavior of plastics pipes is investigated at the Department of Materials Science and Testing of Plastics.

Thermoplastics such as polyethylene (PE) and polyvinylchlorid (PVC) as well as glass fiber reinforced unsaturated polyesters (GF-UP) are continuously gaining importance as pipe materials in gas and water supply systems especially for low pressure applications. The deformation behavior of buried pipes and pipe components under real service conditions depends on the complex loading situation of the system traffic/road/soil/ pipe as schematically illustrated in Fig. 1.

In addition to the internal pressure, the major influence on the deformation behavior of buried thermoplastics pipes is due to super-imposed static soil and dynamic traffic loads at a mean soil temperature of around 5 °C. To ensure safe pipe performance over the required service life period of at least 50 years, quantitative information on the time, temperature and stress level dependent viscoelastic deformation behavior of the pipe material is required.

As it is of course not possible to empirically investigate the deformation behavior of buried pipe systems for a service time of several decades, a test and extrapolation methodology was developed in cooperation with the "Österreichische Vereinigung für das Gas- und Wasserfach" (ÖVGW, Vienna), WIEN-GAS, Vienna and HOBAS Engineering GmbH, Klagenfurt in order to characterize the viscoelastic long-term properties of polymeric pipe materials.

A test methodology based on significantly accelerated tests (test time approx. 4 weeks) and the application of proper polymer physics principles was devel-

oped and implemented to generate characteristic viscoelastic material property functions for any application relevant temperature, a time scale ranging from less than 1 s (traffic loads) to 50 years (long-term static loads) and for various loading conditions (stress levels).

Based on this procedure, the creep behavior of various plastics pipe materials such as PE, PVC and GF-UP was investigated. Typical results are depicted in Fig. 2. These results compare rather favorably with true long-term data determined on similar materials by others. Thus the test methodology based on accelerated short-term tests was found suitable to predict the long-term deformation behavior of various polymeric pipe materials within an extremely reduced effective test time range.

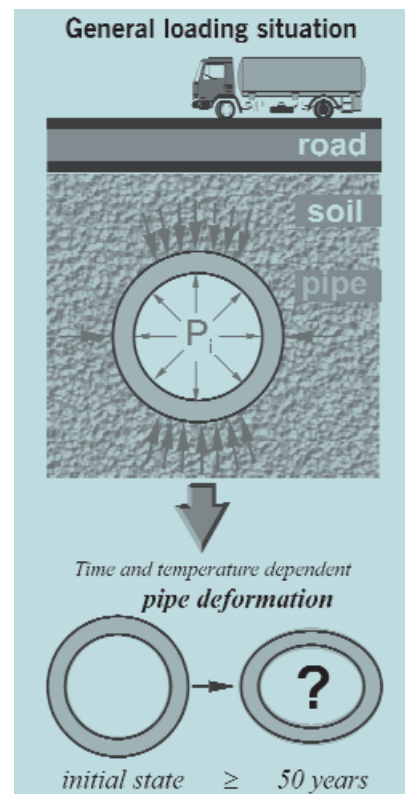


Fig. 1: General loading conditions, deformation of buried pipes, schematically (Illustrations: Department of Materials Science and Testing of Plastics)

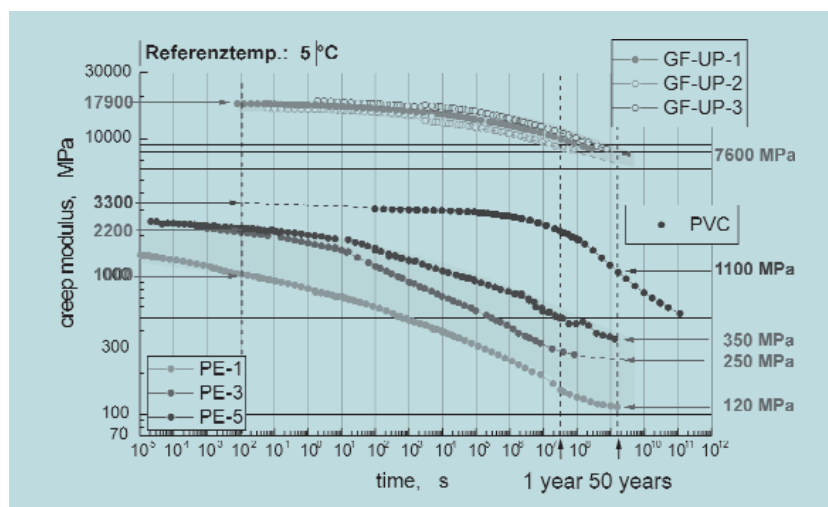


Fig. 2: Time dependent modulus of elasticity for various polymeric pipe materials

Decision Support Model

For the rehabilitation of contaminated sites a Decision Support Model, based on electronic data processing, should be developed. The main aspect is the reuse of old industrial sites. The large amount of influencing factors should be treated in the computer program.

In August 2001 a number of 194 contaminated sites in need of remediation were listed in the Austrian Contaminated Sites Atlas. At the moment 60 rehabilitation projects and precautionary measures are running, altogether 32 projects could be finished so far.

Furthermore 33074 sites, which are suspected to be a hazardous to people's health or the environment in terms of the AISAG, were registered in January 2000. One example is the old industrial site shown below.

28680 of these 33074 sites are old sites and 4394 are old deposits. The rehabilitation of such fallow areas is of public and private interest. It provides economic and even social advantages.

For the simple reason that these discussed sites are well developed as far as traffic and infrastructure are concerned, the great possibility to settle new industry and companies there is obvious. Compared to settling industry on green areas or even unspoiled rural areas the costs are remarkably lower.

Available Technology

At the beginning there was an overwhelming euphoria to clean all the contaminated sites in order to make a multi-functional use of the ground possible again. However, this attempt failed due to the high financial costs.

Due to a number of technical, juridical and organizational reasons the redevelopment of the contaminated sites was more or less left to chance.

Currently the evaluation of the reuse of those sites is preferred to building new industry on green areas. In the first place the focus is on aspects of rehabilitation, because disadvantages of business and economy as well as social aspects are not

quantifiable and therefore not considered.

Combination of different evaluation methods

In support of the evaluation for the reuse of the old sites versus the building of industry on green areas a multi-critical Decision Support Model should be developed.

Subjective values should be standardized understandably. Individual and social aims should be illustrated by their importance. Available tools for this model are the tested evaluation methods such as the comparative-cost-accounting-method, the cost-benefit-analysis, the cost-effectiveness-analysis up to multidimensional methods, for example the multi-objective-planning-method.

Such methods form the basis of the Decision Support Model. The practicability of the methods has to be tested in every single case and has to be optimized by combining them or by developing new tools if necessary. Another emphasis of this R&D project is placed on the description of the optimal organizational and juridical background of the project and additionally the realization of it.

The functional correlation, which results from basic reflections, and clear aims are evaluated with reference to the selected site and checked for their practicability. During this stage of the project rehabilitation technologies, specific for the selected site, are included in the evaluation process.

The combination of the different evaluation methods and the general overview of environment, site, society, technology, etc., form a great innovative access, which shall lead to an optimal solution for all relevant areas.



*Figure 1: old industrial site in Austria
(Photo: Department of Waste Management and Landfill Technology)*

Research Networks

Networking – a keyword of our decade – has been applied by the University of Leoben for a long time.

For approximately 20 years bilateral agreements have existed between the German technical universities Clausthal and Bergakademie Freiberg as well as the University Miskolc in Hungary. 11 years ago the first agreement with the Colorado School of Mines, Golden, USA was signed, which - due to its great success in student exchange - was extended on a broader basis.

These agreements with the aim of promoting science and research (joint projects, exchange of scientists) as well as teaching (mainly student exchange) were and will be carried on on the basis of cooperating institutions.

In addition to this numerous departments of the University of Leoben demonstrated initiative of their own and initiated close connections to related institutions all around the globe.

In the preceding years many universities have joined within the framework of the EU-programs (SOKRATES, TEMPUS and so on), so that a listing of all active cooperations is impossible.

Therefore only those cooperation agreements with universities and research institutions are listed below which were signed in 2001.

Department of Chemistry of Polymeric Materials Research Institute for Electron Microscopy, TU Graz Surface treatment of inorganic fillers for the modification of polymers	Signatory institution Partner Field of cooperation
Department of Chemical Engineering, University Karlsruhe High-temperature pyrolysis of hazardous plastic waste	Partner Field of cooperation
Department of Mathematics and Statistics Technical University Graz Numbertheoretic algorithms and their applications	Signatory institution Partner Field of cooperation
Department of Materials Science and Testing Technical University Graz, University Linz, Joanneum Research and 39 companies K-plus-Competence Center for Plastic Engineering and Polymer Sciences (Polymer Competence Center Leoben)	Signatory institution Partner Field of cooperation
Department of Mechanical Engineering Materials Competence Center Leoben Finite element calculation of a gear wheel	Signatory institution Partner Field of cooperation
Austrian Foundry Institute Fatigue resistance of a sintermetal component	Partner Field of cooperation
Department of Mechanics Industrial Research Promotion Fund Deformation behavior of gamma titanium aluminides	Signatory institution Partner Field of cooperation
OEAD Interactions of phase transformation and deformation in solids	Partner Field of cooperation
Christian Doppler Laboratory for Functionally Oriented Materials Design 1. Microstructure of rail surfaces 2. Cracks and precipitation in continuous casting 3. Ductile crack progress - cohesive zone model 4. Cracks in inhomogeneous materials	Partner Field of cooperation
K-Plus M2 - practically relevant strain of rails M3 - practically relevant strain of switch components	Partner Field of cooperation

Cooperation with Universities and Research Institutions (continued)

Signatory institution Partner	Department of Nonferrous Metallurgy Rhine-land Westphalia Technical University Aachen, Germany and Technical University Delft, Netherlands
Field of cooperation	"DLA" = the light metal axis (Die Leichtmetall Achse) = Delft - Leoben - Aachen
Partner	Technical University, Karlsruhe, Germany
Field of cooperation	Recovery of noble metals from electronic scrap
Signatory institution Partner	Department of Physical Chemistry Max Planck Institute for Solid State Research, Stuttgart
Field of cooperation	Electrodeposition of Ag-structures on solid AgCl with high lateral resolution
Partner	Department of Materials Science and Engineering, Massachusetts
Field of cooperation	Oxygen exchange measurements on electroactive oxides
Partner	Universität Karlsruhe, Vrij Universiteit Brussels, Institut Macromol. Chemistry, Academy of Science of the Czech Rep., Res. Lab. of Materials and Environ. Chemistry, CRC; Hungar. Acad. of Science, University of Torino, University of Helsinki, Sea Marconi Technologies di Vander Tumiatti S.A.S., AHT Anlagenbau-Hochtemperaturtechnik, Brabender OHG
Field of cooperation	"Process integrated thermal treatment of halogens containing materials as source for halogens free fuels for steel production and residues for noble metal recovery"
Partner	Murdoch University, Perth, Australia
Field of cooperation	"Prediction and measurement of physicochemical properties of Bayer liquors"
Signatory institution Partner	Department of Plastic Deformation and Plant Machinery Department of Metal Forming FM TU in Kosice, Slovakia and Masinski Fakultet, Podgorica, Yugoslavia
Field of cooperation	Numerical simulation of forming processes
Signatory institution Partner	Department of Plastics Processing Austrian Research Institute Seibersdorf
Field of cooperation	"Flow-technological examinations on commercial feedstocks for powder injection molding under special consideration of possible flow anomalies"
Partner	Industrial Research Promotion Fund
Field of cooperation	1."Measurements of inner and outer friction coefficient of plastic free flowing stock" 2."Calculation and experimental determination of shrinkage, deformation and internal strain of film coated molds" 3."Influence of screw geometry on film quality"
Signatory institution Partner	Department of Process Engineering Department of chemistry of Polymeric Materials and Department of Nonferrous Metallurgy
Field of cooperation	EU-Project "Halocleanconversion project"
Signatory institution Partner	Department of Structural and Functional Ceramics Materials Center Leoben
Field of cooperation	1.E-module measurement of small samples 2.Development of FEM-models for thermistor simulation
Partner	Austrian Research Promotion Fund
Field of cooperation	1. Crack bridges in aluminum oxides 2. Effect of Size on Strength in Ceramic Materials Containing High Densities of Flaws
Signatory institution Partner	Department of Technical Ecosystem Analysis University of Miskolc, Department of Hydrogeology and Eng.Geology
Field of cooperation	Student exchange
Partner	Charles University, Faculty of Science, Prague
Field of cooperation	Student exchange
Signatory institution Partner	Department of Waste Management and Landfill Technologies Technical University Berlin, University of Santiago de Compostela (Chile), Universidad de Concepción (Chile), Universidad de la Frontera (Chile), European Union, Federal Ministry for Science and Technology
Field of cooperation	Reduction of environmental impacts on leather tanneries

New Impetus for Economy

Following a tradition the University of Leoben establishes close contact with the economy.

The spectrum of the cooperations ranges from "minor" expert reports to major research contracts. Since there are so many cooperations between departments of the University Leoben and the economy and industry, the list is restricted to those cooperations with a contract value above 40,000 Euro in the year 2001.

A total of 49 projects which are mentioned below be-

longs to this category. 14 of the cooperating companies have their headquarters in Styria, a clear indication for the impetus given to the direct industrial environment by the University of Leoben. 27 foreign companies are also mentioned that assigned research contracts of a larger value to University of Leoben.

	CERAMICS	Department Partners
	1. RHI AG, Vienna	
	2. VA STEEL Donawitz GmbH, Donawitz, Styria	
	3. VA STEEL Linz GmbH, Linz, Upper Austria	
Characterization, simulation and optimization of the behavior of refractory building material under mechanical and thermomechanical stress		Project
	HERAKLITH GmbH, Fürnitz, Carinthia	Partner Project
Clarification and avoidance of damages on exterior and interior plaster		
	CONVEYING TECHNOLOGY	Department Partner Projects
	BINDER&CO AG, Gleisdorf, Styria	
Acoustic measurements at continuous conveyors		
New development of a pipe conveyer with a special belt guide		
	BEUMER FACTORY, Beckum, Germany	Partner Project
New development of idler supports for belt guidance in horizontal curves		
	SVEDALA COMPANY, Moers	Partner Project
Synchronism control of pocketlift-vertical conveyors		
	BÖHLER HOCHDRUCKTECHNIK, Kapfenberg, Austria	Partner Project
Seal systems for high-pressure caps		
	PALFINGER COMPANY, Salzburg, Austria	Partner Project
New development of a telescopic crane arm for mobile cranes		
	UNIDO, Vienna	Partner Project
Selection of a drilling plant for the development project India		
	VOESTALPINE, Linz, Austria	Partner Project
Examination of belt alignment		
	BERNEGGER COMPANY, Molln, Austria	Partner Project
Examination of possible conveying methods in modern mining		
	VAB- Zeltweg, Austria	Partner Project
Noise-reduction at partial cutters		
	HAGE COMPANY, Obdach, Austria	Partner Project
New development of a binding machine for structural steel grids		

Department	CHEMISTRY OF POLYMERIC MATERIALS
	Cooperation with Department of Electronmicroscopy, TU Graz Department of Chemistry, University of Graz
Partner	FEDERAL MINISTRY OF TRANSPORT, INNOVATION AND TECHNOLOGY, Vienna FEDERAL MINISTRY OF ECONOMY AND LABOUR, Vienna FEDERAL GOVERNMENT OF STYRIA GRAFITBERGBAU KAISERSBERG, Styria
Project	Surface treatment of inorganic fillers for the modification of polymeres
	Cooperation with Department of Process Engineering, Department of Physical Chemistry, Department for Nonferrous Metallurgy
Project	EU-project "Halogencleanconversion"
Department	ECONOMICS AND BUSINESS MANAGEMENT
Partner	IRONWORKS KRUPP MANNESMANN Ltd., Duisburg, Germany
Projects	Development of a generic management system Development of a crisis and risk management system
Department	ECO-SYSTEM ANALYSIS
	Cooperation with the Department of Waste Management and Landfill Technologies
Partner	Austrian Water and Waste Management Association Vienna, OeNB Jubilee fund
Project	Jubilee fund project No. 8962 - Benchmarking in Waste Management
Partner	Nopro Wärmesysteme Ges.m.b.H., Katsch/Mur, Austria Randa Group S.A., Barcelona, Spanien Technisches Büro Schneider, Trofaiach, Austria Wagner Ges.m.bH., Stallhofen, Austria
Project	Institut de Innovacio Empresarial illes Balears, Palma de Mallorca, Balears EU-Contract No. NNE5/2001/310 "Development of sustainable energy systems for communities adapted to different economic and environmental conditions in 5 European model regions"
Partner	Aristotle University of Thessaloniki, Greece Bulgarian Academy of Science, Sofia, Bulgarien University of Salzburg, Austria Federal Institute of Agricultural Economics, Vienna, Austria Geo Group a.s., Ostrava, Czech Republic InterConsult Group ASA, Fredrikstad, Norway Institute of the Industrial Ecology Problem of the North, Apatity, Russia Terra Environmental Technologies, Budapest, Hungary Friedrich-Schiller-Universität Jena, Germany
Project	University of Miskolc, Hungary EU-Contract No. QLK5-CT-2001-0401 "Innovative models of critical key indicators as planning and decision support for sustainable rural development and integrated cross border regional management in former Iron Curtain areas based on north to south European reference studies"
Department	FERROUS METALLURGY
Partner	VOESTALPINE Stahl Linz GmbH
Project	Microstructure prediction of solidified slabs
Partner	VOESTALPINE Stahl Linz GmbH
Project	Examination of the influence of alloy elements on the shrinkage behavior of solidifying steels
Partner	VOESTALPINE Stahl Donawitz, Corus, Profil Arbed, CRM
Project	EGKS-Project: "New Secondary Cooling Patterns for Peritectic and Microalloyed Steels"

	FOUNDRY TECHNOLOGY	Department
System for composite casting products under consideration of new refractory materials	AUGUST RATH JUN. Ltd., Krummnussbaum, Austria	Partner
		Project
Shrinkage behavior of peritectic steels under cooling conditions similar to continuous casting	VOESTALPINE Steel Linz, Austria	Partner
		Project
Structure prediction of solidifying slabs	VOESTALPINE Steel Linz, Austria	Partner
		Project
New secondary cooling patterns for peritectic and microalloyed steels	VOESTALPINE Steel Linz, Austria	Partner
		Project
	HEAT ENGINEERING	Department
Development of a combustion system based on existing patents of the company for the processing of combustion air and liquid fuel to a gas mixture for the combustion in a special medium	WINDHAGER Central Heating Inc.	Partner
		Project
	MATERIALS SCIENCE AND TESTING OF PLASTICS	Department
Examination of a new method of calculation for centrifugally cast glass fiber reinforced polyester resin pipes	JOANNEUM RESEARCH GmbH, Graz, Styria HOBAS ENGINEERING GmbH, Carylthia	Partner
		Project
Development and property characterization of light-weight sandwich panels	HIGHTECH PRODUCTIONS GmbH, Mittersill, Tyrol	Partner
		Project
	MECHANICAL ENGINEERING	Department
Simulation in component design	BMW Motors, Steyr, Upper Austria	Partner
		Project
	MINING ENGINEERING	Department
EU-project "Less Fines" production in aggregate and industrial minerals industry	together with the Department of Mineral Processing DYNO NOBEL, Oslo, Norway UNION ESPANIOLA EXPLOSIVOS, Madrid, Spain CEMENTOS PORTLAND, Madrid, Spain NORDKALK PARTEK, Gotland, Sweden HENGL BITUSTEIN, Eibenstein, Austria SWEDISH ROCK RESEARCH ENGINEERING, Stockholm, Sweden ECOLE NATIONALE SUPERIEURE DES MINES DE PARIS, Paris, France ESCUELA DES MINAS, Madrid, Spain	Partner
		Project
	NONFERROUS METALLURGY	Department
Avoidance of short circuits in copper electrolysis	CODELCO, Chuquimata, Chile NORANDA, Montreal, Canada ATLANTIC COPPER, Huelva, Spain UNION MINIÉRE, Olen, Belgium NORDDEUTSCHE AFFINERIE, Hamburg, Germany BOLIDEN MINERAL AB, Div.Copper, Sweden OUTOKUMPU OYI, Harjavalta, Finland	Partners
		Project

Department	PETROLEUM ENGINEERING
Partners	(RC) ² Reservoir Characterization, Research and Consulting, Inc., Denver, Colorado, USA HOT Engineering GmbH, Leoben, Styria
Project	Mathematical modeling of hydrocarbon reservoirs
Department	PHYSICAL METALLURGY AND MATERIALS COMPETENCE CENTER
	together with the research institutions: GKKS Research Center Geesthacht Ltd, Geesthacht, Germany Department of Experimental Physics, Chalmers University of Technology, Göteborg, Sweden Electron Microscopy Center Graz, Austria Joanneum Research Ltd., Laser Center Leoben
Partner Projects	BÖHLER EDELSTAHL Ltd, Kapfenberg, Austria 1. Materials scientific principles of the thermal stability of tool steels 2. Hardening with intermetallic phases 3. Structure-property relationship PM-steel
	Together with the research institutions: Department of Physics, University of West Bohemia, Plzen, Czech Republic Research Laboratory of Materials and Environmental Chemistry, Chemical Research Center, Hungarian Academy of Sciences, Budapest, Hungary, Department of Physics and Measurement Technology
Partner Project	RÜBIG Ltd, Wels, Austria Interface optimization of surface treated tools
Partner Project	MIBA SINTERMETAL Inc. Vorchdorf, Austria High-strength sinter parts
	Together with the research institutions: Department of Chemical Technology of Inorganic Materials, TU Vienna MIBA SINTERMETAL Inc. Vorchdorf, Austria TREIBACHER Auernmet Production Ltd, Austria
Partners	
Project	Masteralloys
	Together with the research institutions: Joanneum Research Laser Center, Leoben Joanneum Research for nanostructured materials and photonic, Weiz, Austria
Partner Project	VOESTALPINE Steel Ltd., Linz, Austria Oxide layers on galvanized steel strips
	Together with the research institutions: Joanneum Research Laser Center, Leoben Department of Chemical Technology of Inorganic Materials, TU Vienna Department of Physical Metallurgy and Materials Testing, TU Vienna
Partner Project	BÖHLER EDELSTAHL Ltd., Rübigen Ltd. VOEST-Alpine Steel Linz Ltd. Simulation of tool wear at cold work processing
	Together with the research institutions: GKKS Research Center Geesthacht Ltd., Geesthacht Germany Max Planck Institute for Metal Research, Stuttgart, Germany PLANSEE AG TECHNOLOGIEZENTRUM, TZ, Reutte, Tyrol
Partner Project	Gamma Titanium Aluminides 1. Production and characterization of flat-rolled products 2. Thermal stability of γ -TiAl sheets

PLASTIC DEFORMATION AND PLANT MACHINERY

VOESTALPINE Steel Ltd., Linz, Austria
Warping and bending at the 4.2 m heavy plate mill of voestalpine Steel Linz Ltd.

Department
Partner
Project

VOESTALPINE Plant Construction Ltd., Linz
Cross section control of rolled products in continuous mill trains for long product - minimal tension control

Partner
Project

PROCESS ENGINEERING

BABCOCK BORSIG POWER, Vienna
Multiphase flow simulation in turbo-sorbent plants

Department
Partner
Project

BRAUUNION AUSTRIA, Graz
Thermal utilization of spent hops

Partner
Project

METURA POWDER METAL LTD., Ranshofen, Austria
Atomization of fused metal

Partner
Project

STRUCTURAL AND FUNCTIONAL CERAMICS

EPCOS OHG; Deutschlandsberg, Styria
Mechanical stability of thermistors

Department
Partner
Project

WASTE MANAGEMENT AND LANDFILL TECHNOLOGIES

FFF
ASSOCIATION OF AUSTRIAN DISPOSAL PLANTS
PAPER INDUSTRY ASSOCIATION
FFF-project "Quality assurance and development of quality criteria for secondary fuels"

Department
Partners

Project

FFF
BAUFELD-AUSTRIA LTD.
FFF-project "Thermal utilization of high-caloric fraction from the mechanical-biological residual waste treatment at the production of clinker"

Partners

Project

Discussing Knowledge –

Science thrives on the exchange of experience and ideas. In the year 2001 the departments organized 20 academic events in total, 12 events took place in Leoben itself.

The European Conference on Power Electronics and Application, organized by the Department of Electrical Engineering in cooperation with the EPE Association, is worth a special comment. Roughly 1000 participants from almost all continents attended the world's biggest conference for power electronics and applications at the end of August in Graz. New power electronic applications in high speed traffic engineering, vessel propulsion, in industry related to mining for conveying and processing, for speed variable electrical drives of any kind, in automobile industry and alternative energy were highlighted.

The most recognized experts in reservoir simulation from academia and industry met at the "International Forum on Reservoir Simulation" in Salzburg. More than 90 participants from almost all the petroleum producing countries discussed the latest developments in this

field of knowledge. The event was organized by those two university departments which are worldwide leaders in the development of software for the numeric simulation of petroleum reservoirs: the Department of Petroleum Engineering at Stanford University in California and the Department of Petroleum Engineering at the University of Leoben. The forum has been organized for the sixth time by both departments.

More than 200 experts from academia and industry discussed latest developments in plastic engineering on the 5th Austrian Polymer Conference at the University of Leoben. This conference focused on chemical and physical aspects of plastic engineering and science and was organized by the Department of Chemistry of Polymeric Materials at the University of Leoben, by the Austrian Physical Association and by the Association of Austrian Chemists.

Process Intensification in Primary and Secondary Metallurgy

Organization Department of Nonferrous Metallurgy
Location University of Leoben
Date January 25 - 26, 2001

Surpac-User Meeting 2001

Organization Department of Mining Engineering
Location United Kingdom
Date February 15 - 16, 2001

20th Plastic Deformation Colloquium

Organization Department of Plastic Deformation and Plant Machinery
Location Planneralm
Date February 25 - March 3, 2001

Kick-off Meeting for the EU-Project Less Fines

Organization Department of Mining Engineering
Location Leoben
Date March 1 - 2, 2001

47th Metallurgy Colloquium

Organization Department of Physical Metallurgy and Materials Testing
Location Lech, Vorarlberg
Date April 18 - 20, 2001

45th Foundry Meeting

Organization Department of Foundry Technology and Austrian Foundry Research Institute, Leoben
Location Leoben
Date April 26 - 27, 2001

Annual Asmet Meeting

Organization Department of Ferrous Metallurgy
Location University of Leoben
Date May 21 - 23, 2001

Exchanging Experience

Festive Colloquium "Prof. Dr. W. Imrich - 60th anniversary"

Organization Department of Mathematics and Applied Geometry, Applied Mathematics and the Austrian Mathematical Society
Location Leoben
Date June 2, 2001

Innovations for the avoidance of road damages due to canal construction work

Organization Department of Materials Science and Testing of Plastics, Center of Applied Technology
Location Leoben
Date June 26, 2001

MCL School on Phase Transformation Kinetics

Organization Department of Physical Metallurgy and Materials Testing, Department of Metal Physics, Materials Center Leoben
Location Tofaiach, Styria
Date July 5 - 7, 2001

9th European Conference on Power Electronics and Applications

(International experts and speakers)
Organization Department of Electrical Engineering and EPE Association, Brussels
Location Leoben and Graz
Date August 27 - 30, 2001

6th International Forum on Reservoir Simulation

(International experts and speakers)
Organization Department of Petroleum Engineering
Location Salzburg
Date September 3 - 7, 2001

5th Austrian Polymer Conference

(International experts and speakers)
Organization Department of Chemistry of Polymeric Materials
Location University of Leoben
Date September 12 - 14, 2001

IUPAC working party IV.2.2 "Molecular Characterization of Commercial Polymers"

(International experts and speakers)
Organization Department of Chemistry of Polymeric Materials
Location University of Leoben
Date September 15, 2001

Conference "Recent trends in Graph Theory Algebraic Combinatorics and Graph Algorithms"

Organization Department of Applied Mathematics
Location Bled, Slovenia
Date September 24 - 27, 2001

6th International Workshop on Subsecond Thermophysics

Organization Department of Foundry Technology and Austrian Foundry Research Institute and Department of Experimental Physics, Graz
Location Leoben
Date September 26 - 28, 2001

Congress: Maintenance and Plant Management

Organization Department of Economics and Business Management Austrian Association of Maintenance and Plant Management
Location Hotel Panhans, Semmering
Date October 10 - 11, 2001

Ceramics Colloquium

Organization Department of Ceramics Austrian Society for Ceramics
Location University of Leoben
Date October 19, 2001

One Decade Degree Program Industrial Environmental Protection

Organization Department of Process Technology and Environmental Protection
Location Leoben
Date October 19 - 20, 2001

12th Colloquium Issues of Opencast Mining and Quarry Management

Organization Department of Mining engineering
Location Leoben
Date November 8 - 9, 2001

Going Public

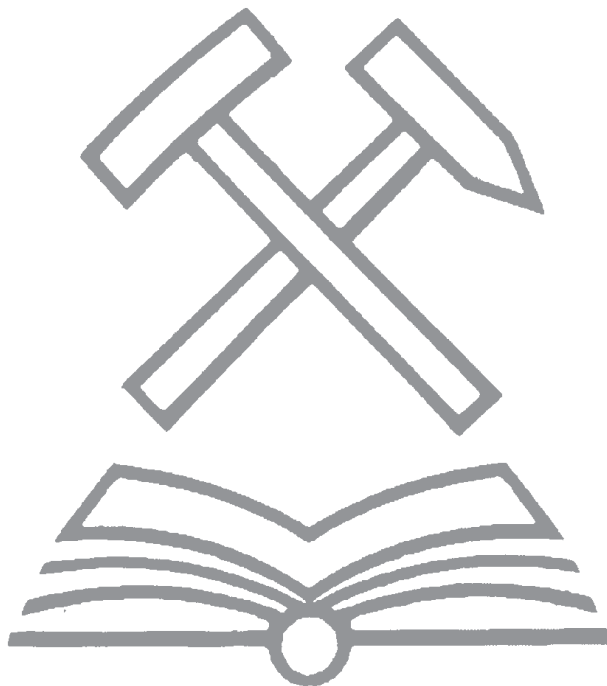
The academic performance, which can be demonstrated by the number of publications, is worth mentioning. If all submitted publications of the year 2001 are added, then there is a total of 836 publications.

Trying to list all publications by scientists at the University of Leoben would go far beyond the scope of this annual report.

Therefore the chart printed below confines itself to mentioning only the number of publications in the different categories.

Without wanting to underestimate the academic performances of the other publications, there is one worth mentioning to which scientists of the Department of Geosciences made a major contribution and won an international award:

For their publication of "The Giant Chromite Deposits at Kempirsai, Ural" in one of the most renowned geological periodicals Mineralium Deposita, the authors Frank Melcher, Walter Grum, Tatjana and Oskar Thalhammer received a prize by the Association of European and American Geologists. An international jury decided that this publication was the best in the years 1999 and 2000. The four geoscientists received the prize of 1500 Euro on the 6th Reservoir Geologist's Conference in August 2001 which takes place only every other year. The prize is awarded only once in two years.



PUBLICATIONS AT THE UNIVERSITY OF LEOBEN IN THE YEAR 2001

Reviewed publications	255
Publications	140
Textbooks and reference books	9
Academic lectures and posters	432
TOTAL:	836

Thank you!

The University of Leoben has to rely on the support by its friends, sponsors and benefactors in its efforts to further develop the opening to the public.

The following individuals and institutions donated money for advertising and public relations in 2001.

Many thanks!

More than 35 Euro

Gesellschaft von Absolventen und Freunden der Montanuniversität Leoben
(Society of Alumni and Friends of the University of Leoben)

Stadtgemeinde Leoben

Robert Reck

Hellmut Longin

Ebner Industrieofenbau

Johann Haslauer

Günter Petzow

Wirtschaftskammer Steiermark

H.J. Mauritsch

Lafarge CTEC

Karl W. Rettenberg

Helmut Moitzi

Karl Leitner

BMG Metalle u. Recycling GmbH

Up to 35 Euro

H.G. Müller

Michael Gruböck

Gernot Wallner

Friedrich Hollmann

Josef Pesl

Hans Beschliesser

Friedrich Niederl

Gerald Kasca

Karl S. Flechsig

Universität für Bodenkultur Wien (University of Agricultural Sciences, Vienna)

Johann Kirner

H. Janeschitz-Kriegl

Elisabeth Herrman

Franz Rittmannsberger

Josef Neges

PERMANENT POSITIONS			
	YEAR 1999	YEAR 2000	YEAR 2001
University Professors	40	40	40
Academic staff (professors excluded)	146	147,5	143
Non-academic staff	210,5	211,5	216
Number of permanent positions in the given calendar year			

Not all permanent positions were occupied continuously in 2001. When employment is ended by retirement, termination of contract or - rather seldom - by dismissal or even death of the employee, a vacancy over a long period is the rule. As for re-appointments in the groups "academic junior faculty" and non-academic staff there are budgetary reasons for a longer vacancy. Is there a longer vacancy due to the sudden leave of a professor then mainly the problems at the search for eligible candidates impede a fast reappointment.

Faculty and Staff

In addition to permanent positions the university management knows of the following private employees, employed by the departments within the framework of their restricted legal capacity for contractual research projects.

Academic staff: 175 persons, a total of 80.05 man-years
 Non-academic staff (incl. student assistants): 86 persons, a total of 21.81 man-years

UTILIZABLE SPACE

YEAR 1999	YEAR 2000	YEAR 2001
47.711	47.977	47.977

Utilizable space at the University of Leoben in m² incl. hallways and sanitary facilities

All data on premises and facilities of the University of Leoben in the period from 1999 to 2001 are summed up in the opposite chart. In 2001 23 lecture halls and seminar rooms were available which were used to 80% of capacity by courses in the winter semester 2001/2002 from Monday to Friday between 8 am and 6 pm. Next to teaching another 86 events took place in the lecture halls in the year 2000, thereof 74 which were organized by university members.

Compared to the previous year no floor space was added.

Energy and Floor Space

Energy Statistics

That year the University of Leoben consumed energy worth about 631,054 Euro.

	EURO
3.3 tons diesel	3,259
5.0 tons fuel oil ultra-light	2,646
582,873 m ³ gas	319,374
2,900,654.5 kWh electricity	305,775
Total	631,054

Financial

BUDGET DISTRIBUTION						
	YEAR 1999		YEAR 2000		YEAR 2001	
	ATS	EURO	ATS	EURO	ATS	EURO
UT 0 (personnel expenses)						
Personnel incl. DGB	217,890	15,835	227,268	16,516	235,139	17,088
Visiting professors incl. DGB	694	50	224	16	95	7
Allowances for faculty members	896	65	900	65	1,023	74
Total expenses UT 0	219,480	15,950	228,392	16,598	236,257	17,169
UT 3 (Investments)						
Appointments - Investments	13,107	953	4,182	304	9,900	719
Investments Departments	17,079	1,241	6,502	473	5,420	394
Investments Service Sector	7,217	524	2,873	209	3,774	274
Miscellaneous	2,516	183	327	24	880	64
“Universitätsmilliarde”					4,547	330
Total expenses UT 3	39,919	2,901	13,884	1,009	24,521	1,782
UT 7 (External Teaching)						
Academic staff in training						12
Adjunct faculty and visiting professors	6,735	489	7,423	539	7,493	545
Visiting lecturers	398	29	383	28	483	35
Student assistants and tutors	2,100	153	1,872	136	2,051	149
DGB, miscellaneous	2,763	201	2,234	162	2,263	164
Total expenses UT 7	11,996	872	11,912	866	12,460	906
UT 8 (Operating expenses)						
Operating expenses of departments	23,800	1,730	22,290	1,620	19,697	1,431
Operating expenses incl. services and others	48,260	3,507	46,365	3,369	48,978	3,559
Foreign relationship	1,600	116	789	57	581	42
Z-Posts (imbursements, contributions)	2,000	145	2,300	167	2,311	168
“Universitätsmilliarde”					2,858	208
Total expenses UT 8	75,660	5,498	71,744	5,214	74,425	5,409
TOTAL	347.055	25,221	325.932	23,686	343.531	24,965
Allocation of Budget in ATS 1000 and EURO 1000 (rounded)						
DGB ... social security and retirement contributions						

THIRD PARTY INCOME						
	YEAR 1999		YEAR 2000		YEAR 2001	
	ATS	EURO	ATS	EURO	ATS	EURO
Third Party Income (for investments & personnel)	67,720	4,921	95,890	6,969	102,547	7,452
Income of the departments for finished projects in the given calendar year in ATS 1000 and EURO 1000						

Report

Compared to the poor financial year 2000 the University received more money from the "university billion".

Allocation of means from the "university billion"

After a poor fiscal year 2000 there was a slight increase in staff appropriations and external teaching, the investment appropriations also increased noticeably. Euro 500,000 (ATS 7 million) in total were allocated from the "university billion".

Personnel expenses

Despite the increase of staff appropriations from ATS 228.4 million (Euro 16.6 million) in the year 2000 to ATS 236.3 million (Euro 17.17 million) in 2001 it was still not possible to fill all available permanent positions, for full occupation roughly ATS 10 million (Euro 0.72 million) are missing.

Investments

The table on the left shows that the budget volume for investments could be raised compared to the year 2000. Due to cut backs by the government it is still far less than in the year 1999. The allocations from the university billion were used to increase the number of student jobs, to improve the equipment of the lecture halls, for other projects with the main focus on teaching and to install an "interdisciplinary simulation network metal-

lurgy". In addition both departments and service institutions received ATS 9.9 million (Euro 719,461) as well as other investment sums.

External teaching

The increase of the budget of roughly ATS 0.5 million (Euro 36,336) compared to the previous year made it possible to sustain the high quality of the range of courses within the strategic core areas at the University of Leoben on the one hand and to pay bonuses for special achievements. Furthermore the new employment law also includes means for "academic staff in training".

Operating expenses

The extremely rapid development of the EDP-sector made it necessary to invest more money than in the year before. Especially in this respect some projects with the main focus on teaching could be realized by means of allocations from the university billion.

A special allocation was used to support the Industrial Liaison Department with an amount of ATS 2.3 million (Euro 167,148) for operating expenses. Telephone costs could be cut back further, a very positive development.

Budgetary Priorities

In addition to implementing reductions the following priorities concerning the allocation of the budget were set:

- keeping of appointment commitments
- extension of public relations
- an interdisciplinary simulation network metallurgy
- support of the Industrial Liaison Department
- investments to improve the study conditions

Excellent!

Honors and awards for scientists at the University of Leoben



Univ.-Prof. Dipl.-Ing. Dr. Franz Jeglitsch, Federal Governness Waltraud Klasnic

For his achievements as rector as well as being member of the regional parliament Prof. Dr Franz Jeglitsch received the "Große Goldene Ehrenzeichen", a decoration by the Federal Governness Waltraud Klasnic. From 1987 to 1991 the head of the Department of Physical Metallurgy and Materials Testing was the rector of the university. His period of office was marked by many innovations. The new fields of studies Applied Geosciences and Industrial Environmental Protection were introduced. The Peter-Tunner-Building was finished. Jeglitsch also initiated increased research in "high performance materials" and successfully applied for the materials competence center "Materials Center Leoben", which was established in 1999.



Univ.-Prof. Dipl.-Ing. Dr. Horst Wagner

The South African National Institute of Rock Engineering granted Prof. Dr. Wagner Head of the Department of Mining Engineering the Life Time Achievement Award. Additionally he was appointed vice president by the international organizational committee of the world mining engineering congress.

The Department of Mining Engineering received a distinction from the ministry for its excellent contribution in the framework of the Science Week 2001 "cracking materials – treasure hunting in mines".



Prof. Dipl.-Ing. Dr. Christian Mitterer

Due to excellent achievements in the field of "physical surface technology" Dr Christian Mitterer, Professor at the Department of Physical Metallurgy and Materials Testing received the Erich Schmid Award of the Academy of Sciences. Every second year this prize is awarded to physicists who are younger than 40 for their excellent achievements in the field of experimental or theoretical physics.

In recognition of the best contribution

to the E-MRS 2001 Spring Meeting (Strasbourg, France) Dipl.-Ing. P.H. Mayrhofer received the Young Scientist Award. Dipl.-Ing. P.H. Mayrhofer studied Materials Sciences (Rektor-Platzer-Ring) and passed his PhD in 2001 with distinction, at the moment he is assistant at the Department of Physical Metallurgy and Materials Testing.

Dr. Peter Supancic, assistant at the Department of Structural and Functional Ceramics received the Styrian Research Promotion Award 2001 for a new function analysis of PTC resistor components. He is the only one who was awarded this prize in 2001.

Dr. Heinz Leitner and Dipl.-Ing. Martin Riedler, both assistants at the Department of Mechanical Engineering were the winners of the Automobile Association Donation of the Austrian Automobile Industry Association on March 23, 2001.

Em.O.Univ.Prof.Dr.Dr.h.c.G.B.L. Fettweis received the Josef-Krainer Memorial Award for decades of efforts in the field of mining engineering.

In the framework of the 20th H.F. Mark symposium Hon.Prof.Dipl.-Ing.Dr.mont. Alfred Lampl received the F. Mark-Medal.



Dr. Peter Supancic

Honors, awards and appointments by the University of Leoben



In the year 2001 three public figures were conferred the status of honorary senators - a fact worth mentioning. Federal Governness Waltraud Klasnic, CEO Dr Knut Konsemüller - and the late General Manager Dr. Peter Strahammer became honorary senators at commencement.

At commencement on June 29, 2001 the mayor of Leoben Dr. Mathias Konrad was given the freedom of the university.

On Dec 1, 2001 Prof. Dr. Wilfried Krieger assumed office at the Department of Ferrous Metallurgy and succeeded Prof. Dr. Herbert Hiebler who retired on Oct 1, 2001 as Head of the Department.

With Prof. Krieger, the University of Leoben welcomes another scientist with profound experience in industry amongst the ranks of its professors. For more than a decade he was the research manager of voestalpine and gained great experience in the implementation of scientific research in metallurgy. He promotes a "stronger networking with industry" and wants to set up "interdisciplinary teams that concentrate on common issues". He graduated in Leoben and after he received his PhD, he started to work as a research assistant at VOEST Linz. The activities of Prof. Krieger will significantly contribute to the strategic mission to present and promote the university as a "Center of Excellence" in the fields of "Mining, Metallurgy, Materials" to the public.

Dr. Thomas Meisl, member of the Department of General and Analytical Chemistry earned vena docendi as lecturer for geochemistry, Dr. Christian Teichert, Department of Physics, for the subject Material Physics and Dr. Gerd Rantitsch, Department of Geology, for the subject Geology.



Prof. Dr. Wilfried Krieger

IN MEMORIAM

The University of Leoben mourns the loss of two university members who were snatched from this life unexpectedly.

On August 23, 2001 General Manager Dr. Peter Strahammer had a fatal accident on a hiking tour near Wolfgangsee. Dr. Strahammer was a member of the university advisory board and as a man of industry set great interest in strengthening Leoben as university site.

On December 8, 2001 Dr. Rudolf Wüstrich died. Dr. Wüstrich was the former head of the highest mining authority in our Federal Ministry for Economic Affairs. Wüstrich was also member of the diploma examination board for petroleum engineering and the university advisory board of our university. From 1989 to 1991 Dr. Wüstrich was the president of the Austrian Miner's Association.

The deceased will always be remembered at the University of Leoben.

Excellent! (continued)

Honors and prizes for graduates and students at the University of Leoben

Rector-Platzer-Ring

On the occasion of the 125th anniversary celebrations of the University of Leoben, the former "Mining Academy", an honorary ring - the Rector-Platzer-Ring - was donated for graduates who completed their studies with honors. Representatives of this foundation are "ASMET" (Austrian Society for Metallurgy) and the Austrian Mining Association as founding members as well as the "Austrian Society of Petroleum Engineering" and the "Union of Plastic Engineers in Leoben".

In a meeting on February 26, 2001 the board of professors decided not to award the Rector-Platzer-Ring to students anymore who only passed the third stage of study in Leoben. New guidelines for the award of the Rector-Platzer-Ring were also set up in 2001:

1. the third diploma examination must be passed with distinction
2. the GPA of all diploma subjects of the II. and III. diploma examination including the grade of the thesis must be better or equal to 1.5
3. No grade may be worse than "average" on all course and diploma exams during the II. and III. stage of study.
4. The total number of semesters taken must not exceed 12.

In 2001 the following ladies and gentlemen were awarded the Rector-Platzer-Ring at commencement:

Dipl.-Ing. Michael Krassnitzer,
Petroleum Engineering
Dipl.-Ing. Markus Reinhold Sauer,
Petroleum Engineering
Dipl.-Ing. Markus Andreas Mostegel,
Petroleum Engineering
Dipl.-Ing. Herbert Fischer,
Petroleum Engineering
Dipl.-Ing. Daniel Dominique Meyer,
Petroleum Engineering
Dipl.-Ing. Ralf Strasser,
Petroleum Engineering
Dipl.-Ing. Jörg Christian Korp,
Metallurgy
Dipl.-Ing. Martin Riedler,
Mechanical Engineering
Dipl.-Ing. Michael Kerschbaumer,
Mechanical Engineering
Dipl.-Ing. Mark Tratnig,
Mechanical Engineering
Dipl.-Ing. Barbara Aichmayer,
Materials Science
Dipl.-Ing. Jürgen Markus Lackner,
Materials Science
Dipl.-Ing. Rupert Kogler,
Industrial Environmental
Protection.

Em. Prof. Dipl.-Ing. Dr.techn. Rudolf POSSELT's Travelling Fund

The Posselt's Travelling Fund annually donates a prize which is awarded to excellent graduates in natural sciences at the University of Leoben. This fund intends to support young engineers finan-



cially for research trips in the course of their scientific career. In 2001 this prize was awarded to

Dipl.-Ing. Dr. Arne Ragossnig.

Prize of the Austrian Gas & Water Association

The prize of the Austrian Gas & Water Association was awarded to Dipl.-Ing. Dr. Gerald Pinter, Department of Materials Science and Testing of Plastics, for his doctoral thesis: "Crack Growth Behavior of PE-HD under Static Strain".

Roland-Mitsche-Prize

Every other year the Roland-Mitsche-Prize is awarded for achievements in the fields of arts and sports to students or other university members. It is named after Prof. Dr. mont. Roland Mitsche who gained merits for his concern for extra-curricular cultural activities and sports at the University of Leoben. This year's winner is Dipl.- Ing. Franz Gotthard.

RAG-Sponsorship

In 2001 the RAG-Sponsorship of 3633 Euro for the first time ever went to a female student – to Ulrike Prenner. The second prize winner Stefan Pöllitzer could have the benefit of the prize, too. The RAG-Sponsorship supports Petroleum engineering students with excellent credits so that they can finance their obligatory semester abroad.

Huber+ Suhner Prize

The Huber+Suhner Prize for excellent diploma theses went to

Dipl.-Ing. Konrad Fischer and
Dipl.-Ing. Christian Wolf.

Honorary Prize of the Austrian Ministry of Education, Science and Culture (BMBWK)

Dipl.-Ing. Markus Andreas Mostegel was awarded the honorary prize of the Austrian Minister of Education, Science and Culture as best graduate of the University of Leoben in the academic year 2000/01. Mostegel studied Petroleum Engineering.

Environmental research prize of voestalpine Inc.

The environmental research prize of voestalpine Inc., awarded for excellent diploma and doctoral theses, which contribute essentially to the enhancement of environmental protection, went to

Dipl.-Ing. Werner Fragner,
Dipl.-Ing. Jürgen Lackner and
Dipl.-Ing. Christoph Steinberger.

RHI Student Support Program

The RHI-AG program supports first-year students and students in higher semesters with excellent performance at school and university. In 2001 the prize went to:

Elisabeth Radler,
Thomas Auer,
Andreas Michelitsch and
Thomas Perterer.

Festivities and Events

In addition to traditional festivities such as the "Ledersprung" or the university ball numerous events took place in 2001.

Our university was also visited by foreign delegations and public figures from Austria and abroad. Some of the highlights are given below.

Austrian Technology Transfer Meeting

The 2nd Technology Transfer Meeting was organized at the University of Leoben on March 22 and 23, it had the motto "Innovations in Production, Automation and Quality Assurance". Well-known scientists of the University of Leoben, the Technical Universities Graz and Vienna and Joanneum Research gave lectures on future technologies in these fields of knowledge.

"Montanistischer Abend"

"Montanistisch" (Latin: mons, montis, the mountain) refers to sciences, traditions etc. related to mining engineering. On April 4 the "montanistische" evening took place in the auditorium. DDr. Gerhard Sperl held a speech on the topic "History and Tradition of the University of Leoben".

Science Week 2001

Seven departments of our university and 3 schools in Leoben participated in the Science Week on May 18 and 19. Once more this event was received with great interest by the Leoben residents.

Visit by an Iraqi delegation

A high-ranking Iraqi delegation followed the invitation of the VAI in cooperation with the Department of Petroleum Engineering. Representatives of the Iraqi Petroleum Ministry and pipeline industry came to the university. The aim of the visit was the working out of major projects with the Austrian plant construction industry after the embargo and the preparation of future cooperations.

Laser Center and Erich Schmidt-Institute

In addition to numerous anniversary celebrations which were already described

in the chapter "Academic events" another two anniversaries have to be mentioned. The Laser Center had its tenth anniversary on May 10 and the Erich Schmidt-Institute its thirtieth on October 15. Both institutions are a mainstay for Leoben as a university town.

The Dean of the University of Akron, Ohio visits Leoben



On October 14, Graham S. Kelly, Dean of the University of Akron, Ohio (2nd from left) visited the University of Leoben for a few days. Dean Kelly mainly concentrated on Mechanical Polymer Engineering and held an extremely interesting lecture on this subject. The visit of Dean Kelly forged the first link to the University of Akron and demonstrates the efforts of the University of Leoben to internationalize the degree programs and to increase international student mobility.

Bishop Kapellari visits the University

Together with the Catholic Dean Feischl and student pastor Janser, bishop Dr. Egon Kapellari visited our university.

Visit by Federal Governness Klasnic



The visit of Federal Governness Klasnic on October,30 gave the university the



Science Week: Departments of the University organized a thrilling and comprehensible presentation of science



Photo Freisinger

EVENTS for Students extracurricular activities

chance to explain its strategy concept "Mining -Metallurgy - Materials". She promised her financial support for the implementation of the concept and agreed to support the project of a technical annex for plastic and automation. These promises helped the university essentially to reach the desired aim faster.

Bavarian TV-team at the University



For two days a team of the Bavarian TV station filmed in Leoben, on November 29 and 30. The focus was on research and teaching in the core areas "Mining, Metallurgy and Materials". The simulation program for the calculation of petroleum reservoirs, already applied by many leading petroleum producers, and the optimization of metallurgical casting processes were central themes. The unique student-faculty ratio at our university was also documented by the TV-teams. The report was on TV in the framework of the eight-part series "Campus Europe - between Bosphorus and the North Cape" on December 20.

Mining Academy Krakau

Conducted by vice rector Prof. Barchanski 50 members of the academic staff and students of the Mining Academy Krakau visited Leoben on November 9. Krakau is mainly interested in student exchange and also has agreements with Clausthal and Freiberg in this respect.

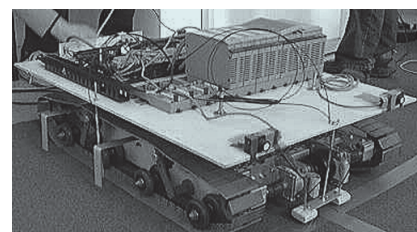
FIT for the University of Leoben



On February 15, the University organized a recruitment day for interested female high school student in the framework of the program "Women for Engineering Jobs" The program "FIT - Women for Engineering Jobs" intends to attract more female high school graduates to technical degree programs.

Robot Grand Prix

16 Austrian and foreign students attended the seminar Autonomous Mobile Robots which is organized by the Department of Automation each year. This event has taken place for the fifth time now and is always accepted with great excitement.



Autonomous Mobile Robots Seminar: Robots as high-performance racing cars (photo: Department of Automation)

Contact Forum 2001

In total 17 well-known companies presented themselves at the Contact Forum on May 29. The event was organized by IAESTE and essentially contributes to bridging the gap between economy, university and students.

Welcome Party

On October 3, 2001 the traditional welcome party for first-year students took place. This party was attended and thoroughly enjoyed by the youngest members of our university.



Departments at

E-mail-addresses and heads of departments

Automation

automation@unileoben.ac.at
O.Univ.-Prof. Dr. O'LEARY

Ceramics

ghk@unileoben.ac.at
O.Univ.-Prof. Dr. HARMUTH

Chemistry of Polymeric Materials

polychem@unileoben.ac.at
O.Univ.-Prof. Dr. LEDERER

Conveying Technology

foerder@unileoben.ac.at
Univ.-Prof. Dr. KESSLER

Designing Plastics and Composite Materials

verbund@unileoben.ac.at
O.Univ.-Prof. Dr. WÖRNDLE

Economics and Business Management

bwl@unileoben.ac.at
O.Univ.-Prof. Dr. BIEDERMANN

Electrical Engineering

etechnik@unileoben.ac.at
O.Univ.-Prof. Dr. WEISS

Ferrous Metallurgy

eisen@unileoben.ac.at
Univ.-Prof. Dr. KRIEGER

Foundry Technology

giesskd@unileoben.ac.at
O.Univ.-Prof. Dr. BÜHRIG-POLACZEK

General and Analytical Chemistry

allgchem@unileoben.ac.at
O.Univ.-Prof. Dr. WEGSCHEIDER

Geomechanics, Tunneling and Heavy Construction Engineering

geomech@unileoben.ac.at
O.Univ.-Prof. Dr. GOLSER

Geophysics

geophys1@unileoben.ac.at
O.Univ.-Prof. Dr. MILLAHN

Geo Sciences

Univ.-Prof. Dr. DIAMOND

Geology

geologie@unileoben.ac.at

O.Univ.-Prof. Dr. EBNER

Mineralogy und Petrology

mineral@unileoben.ac.at

Univ.-Prof. Dr. DIAMOND

Prospection and Applied

Sedimentology

sedigeo@unileoben.ac.at

O.Univ.-Prof. Dr. VORTISCH

Technical Ecosystem Analysis

oekosys@unileoben.ac.at

Univ.Prof. Dr. WOLFBAUER

Heat Engineering, Industrial Furnaces and Power Economy

warmetec@unileoben.ac.at

O.Univ.-Prof. Dr. KEPPLINGER

Materials Science and Testing of Plastics

iwpk@unileoben.ac.at

O.Univ.-Prof. Dr. LANG

the University of Leoben

Mathematics and Applied Geometry

O.Univ.-Prof. Dr. IMRICH

Applied Geometry

anggeom@unileoben.ac.at

O.Univ.-Prof. Dr. SACHS

Applied Mathematics

angemath@unileoben.ac.at

O.Univ.-Prof. Dr. IMRICH

Mathematics and Statistics

mathstat@unileoben.ac.at

O.Univ.-Prof. Dr. KIRSCHENHOFER

Petroleum Engineering

petrol@unileoben.ac.at

O.Univ.-Prof. Dr. Dr.h.c. HEINEMANN

Physical Chemistry

pchem@unileoben.ac.at

Univ.-Prof. Dr. SITTE

Physical Metallurgy and Materials Testing

imw@unileoben.ac.at

O.Univ.-Prof. Dr. Dr.h.c. JEGLITSCH

Mechanical Engineering

ammul@unileoben.ac.at

Univ.-Prof. Dr. EICHLSEDER

Physics

physics@unileoben.ac.at

O.Univ.-Prof. Dr. KUCHAR

Mechanics

mechanik@unileoben.ac.at

O.Univ.-Prof. Dr. FISCHER

Plastic Deformation and Plant Machinery

verform@unileoben.ac.at

O.Univ.-Prof. Dr. Dr.h.c. SCHWENZFEIER

Metal Physics

Academy of Sciences

metallph@unileoben.ac.at

O.Univ.-Prof. Dr. FRATZL

Plastics Processing

ikv@unileoben.ac.at

O.Univ.-Prof. Dr. LANGECKER

Mine Surveying and Mining Damages

ifmub@unileoben.ac.at

O.Univ.-Prof. Dr. STEINER (prov.)

Process Engineering and Environmental Protection

vtiu@unileoben.ac.at

O.Univ.-Prof. Dr. KEPPLINGER

Mining Engineering

bergbau@unileoben.ac.at

O.Univ.-Prof. Dr. WAGNER

Structural and Functional Ceramics

isfk@unileoben.ac.at

O.Univ.-Prof. Dr. DANZER

Nonferrous Metallurgy

nemetall@unileoben.ac.at

O.Univ.-Prof. Dr. PASCHEN

Waste Management and Landfill Technologies

enttech@unileoben.ac.at

O.Univ.-Prof. Dr. LORBER



From 1840 till now

The history of the University of Leoben is marked by a continuous development of the academic range of studies.

Due to an initiative of Archduke Johann the "Styrian Corporate School of Mining" was established in Vordernberg on November 4, 1840. The inaugural address of Peter Tunner demonstrates the intention of keeping the instruction on an academic level and of developing his school to a center for all experts in mining and metallurgy from the alpine region.

The revolutionary year 1848 put an end to extremely successful years in Vordernberg and led to a significant change. Peter Tunner initiated the nationalization of his school and the transfer to the nearby town of Leoben. On November 1, 1849 the "Imperial and Royal School of Mining" could be inaugurated in Leoben with 48 students initially enrolled.

On December 15, 1874 the "Imperial and Royal School of Mining" received a new statute which guaranteed a sound and steady development. The status of the teachers was ranked equal to the status of professors at Technical Universities.

An imperial decree of July 31, 1904 changed the name of the mining academy to the "University of Mining". Equal status to technical universities was finally gained when the academy was entitled to bestow doctoral degrees. In the fall of 1910 the university could move into new quarters which were extremely spacious for those days. Due to the rapid development of mining engineering the fields of studies Mining Engineering and Metallurgy were separated in the interval between World War I and II and a new study program was developed. In 1934 the administration of the University of

Mining and of the Technical University of Graz were united and the two preparatory years of studies were transferred to Graz. This meant a serious decrease in enrolment which was followed by a severe lack of a young generation of academics for the Austrian mining industry. The re-installation of the independent University of Mining by the federal law of April 3, 1937 was due to the joint efforts of industry, professors and all residents of Leoben.

An era of steady development was interrupted again by the annexation of Austria to the Third Reich in 1938. World War II brought serious interferences in studying. These problems could be mastered by a decisive rector after 1945 and an urgently needed extension for laboratories was built.

Rapid stabilization

The rapid stabilization after the war can also be seen in the increasing number of enrolment. After 1955 new fields of studies were added continuously, which in addition to the core subjects encompass a broad range of subject areas from raw materials to materials.

In 1970/71 the fields of studies Plastic Engineering and Materials Science were added. In 1990 the planning of two new fields of studies, Applied Geosciences and Industrial Environmental Protection was begun, they were installed in 1992. The construction of a new building, opened in 1970, also demonstrates this growth. Since October 1, 1975 the university was named "Montanuniversität Leoben" according to the University Organization Act.

UNIVERSITY OF LEOBEN

Franz-Josef-Str. 18, A-8700 Leoben, Austria | Tel. +43 (0)3842 402-0 | Fax +43 (0)3842 402-308

RECTOR'S OFFICE

Tel. +43 (0)3842 402-201
Fax +43 (0)3842 402-502
rektor@unileoben.ac.at

VICERECTOR'S OFFICE

Tel. +43 (0)3842 402-9021
Fax +43 (0)3842 402-9022
sekvize@unileoben.ac.at

DEAN'S OFFICE

Tel. +43 (0)3842 402-300
Fax +43 (0)3842 402-502

INDUSTRIAL LIAISON DEPARTMENT

Tel. +43 (0)3842 46010
aussenin@unileoben.ac.at

REGISTRAR'S OFFICE

Tel. +43 (0)3842 402-204
Fax +43 (0)3842 402-502
veitsch@unileoben.ac.at

STUDY ABROAD CENTER

Tel. +43 (0)3842 402-9021
Fax +43 (0)3842 402-9022
sekvize@unileoben.ac.at (EU-programs)
Cornelia.Praschag@notes.unileoben.ac.at

PUBLIC RELATIONS OFFICE

Tel. +43 (0)3842 402-9025
Fax +43 (0)3842 402-9022
Thomas.Winkler@notes.unileoben.ac.at

EDUCATION & SPORTS DEPARTMENT

Tel. +43 (0)3842 46103
Fax +43 (0)3842 46103-12
ibus@unileoben.ac.at

AUSTRIAN STUDENT UNION AT UNIVERSITY OF LEOBEN

Tel. +43 (0)3842 45272
Fax +43 (0)3842 45272-45
oehs@unileoben.ac.at
<http://oehwww.unileoben.ac.at>



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Degree Programs



In Austria the ten degree programs at the University of Leoben - ranging from raw materials to component/systems - can only be studied in Leoben.

Mining Engineering
 Requirements Mining
 Processing and refining
 Geomechanics and tunneling

Mine Surveying
 Requirements Geoinformatics and datamanagement
 Mine damages and environmental techniques

Petroleum Engineering
 Electives International Study Program
 Simulation Technologies
 Business management

Metallurgy
 Electives Ferrous metallurgy
 Non-ferrous metallurgy
 Metal forming
 Casting and component design
 Industrial economy, energy and environment technology

Ceramics

Mechanical Engineering
 Modules Computational Design
 Automation and Performance Testing
 Plant and Heavy-Machinery

Plastic Engineering
 Electives Polymeric materials development and characterization
 Production technology & component design
 Requirements Polymeric Materials and sustainable development
 Quality assurance and management
 Operation & production management



Materials Science
 Electives Metallic Materials
 Metal physics and general material physics
 Ceramic materials
 Materials of electronics
 Requirements Biomaterials
 Modelling and simulation
 Polymeric materials
 Project and quality management

Applied Geosciences
 Electives Applied geophysics
 Petroleum geology
 Raw material geology
 Environmental geology and hydrogeology

Industrial Environmental Protection, Disposal Techniques & Recycling
 Requirements Process engineering
 Waste disposal and waste management
 Electives Recycling technology
 Industrial engineering/design
 Environmental management/safety
 Contaminated sites
 Automation
 Applied business management
 Plant construction
 Alternative energy
 Noise and radiation protection