# Preface

On September 2-5, 2013 the International Conference on Solidification and Gravity was organized again in Miskolc-Lillafüred. 85 foreign participants from 25 different countries and 30 Hungarian participants took part in the conference and held 85 oral and 30 poster lectures in 17 different sections. Among the 9 invited lectures two reviews were prepared about the MICAST and CETSOL ESA projects. The 2013 conference was a memorial one for Professor Hans Eckart Exner and Professor Erik György Fuchs who had died in the period between the previous (2008) and the last (2013) conference. These two famous men – two good colleagues – were dominant in the research of materials science in Germany and Hungary. They dealt with not only the problems of solidification but many different things in the field of materials science.

The cultural events of high spirits accompanied the conference as usual. The Dixieland Band of Miskolc gave a concert, the participants of the conference took part in a night bathing in the Cave Bath of Miskolc-Tapolca that has a European fame and they tasted the Tokaji Aszú – King of the Wine – in the Szögi Cellar in a tuff cave in Tokaj-Hegyalja.

András Roósz
Conference chairman

**Inaugural of the Conference**

by

István Lakatos

Chair of Regional Committee of Hungarian Academy of Sciences in Miskolc

Ladies and Gentlemen, dear Colleagues, Friends!

On behalf of the Hungarian Academy of Sciences and its North-Hungarian Committee, it is a privilege for me to welcome you here at the 6th Conference on Solidification and Gravity. The mission of our regional committee is to integrate, support, and encourage the scientific activity contributing to the industrial, economic, and cultural progress. Among others, our firm obligation and duty is to organize meetings, forums and conferences, which offer opportunity for professionals to present their new scientific results, exchange and cross-fertilize thoughts and set new directions of fundamental and applied research.

The conferences are outstanding events of the scientific life. We do believe that the conferences are fiestas and summits of sciences. However, as Aaron Klug, Nobel laureate in chemistry wrote, "Research is not a wondering from summit to summit, but we have to go down the valleys and work hard, permanently, and with obligation". Would you allow me to cite another famous science writer, Brian Silver, who told the following "Science is greatest intellectual adventure of mankind". Maybe he is right, but when I am looking back to my scientific career, it is rather a service, serving the local community, organization and the Hungarian science. My driving force was the human curiosity to recognize secretes of nature. As Professor Charles Osgood wrote in a preface of a book entitled "Sciences Odyssey" "the more we come to know, we realize how little we know. The more we understand, it is clearer that what we have learned is nothing compared to what we have yet to learn. Behind each locked door we have managed to open are still more doors to open ad infinitum. So, science is not an arrival, but a journey". I wish you to open many doors at this conference. Forge ahead with creative discussions, strengthen old friendships and find new friends, and enjoy the warm atmosphere of the conference. Moreover, if you have good impressions come back, we are waiting you back at the 7th conference on Solidification and Gravity.

Ladies and Gentlemen! I wish you all the best; have excellent presentations, critical, but creative discussions. Good luck and thanks very much for your gratitude coming here to Lillafüred, Hungary.

**In Memoriam Prof. Dr. Dr.h.c. György Erik Fuchs**

A. Roósz
University Of Miskolc, Institute of Materials Science

Prof. Dr. Dr.h.c. Erik Fuchs metallurgical engineer, one of the establishers of material science in Hungary who started the researches of space material technology and was the master of a lot of researchers and lecturers playing a leading role in the field of material science departed this life on 27th of December 2011.

György **Erik Fuchs** was born on 12th of June in 1930 in Győr. He graduated from Sopron in metallurgical engineering (1952), the Doctor of Technology was conferred upon him in 1963 in Miskolc; he became the candidate of technical science (1962) and later the Doctor of Technical Science (DSc, 1974). He became the honorary professor of University of Miskolc in 1985 and Dr. h.c. honorary doctor of University of Miskolc in 2004.

He was a full-time PhD student, later a research worker then the head of department and at last the first engineer of organization of research at the former Research Institute of Iron Industry (VASKUT) and at its successor institute from 1952 to 1987. After ceasing VASKUT, he was the managing director of Instrument Centre of University of Miskolc from 1987 to 1990 when he retired on a pension. After retiring, for three years, he was the organizer and the managing director of the Innovation Office of University of Sopron and the Technological Centre of Sopron planned in the framework of an international cooperation (1990-1993).

He actively took part in the higher education since he became a university student: he was the demonstrator of Department of Physics of Faculty of University of Sopron since 1949. He educated the students of Technical University of Budapest, the students attending the Institute of Further Education for Engineers but mainly the students of Department of Physical Metallurgy of University of Miskolc (ME). He was a guest-lecturer at the Freiberg Mining Academy for a semester (in 1972) and a guest researcher at the Department of Applied Physics of Technical University of Vienna as a holder of a scholarship of Collegium Hungaricum (1972/73).

Since 1970, he was the member and office-bearer of the different committees of Hungarian Academy of Sciences (Committee of Structure of Metals, Committee of Material Science and Technology, Complex Committee of Research of Solid Bodies of Hungarian Academy of Sciences, Special Committee of Physics of Cosmos of Intercosmos Board of Hungarian Academy of Sciences etc.) for decades. He took part in the activity of Scientific Qualification Committee (TMB); he was the member of the Special Committee of Physics and Astronomy of TMB for a

certain period. Since 1980, he was the member and co-ordinator of the Hungarian National Board of International Space Research Committee (COSPAR). He participated in the work of OMFB (National Technical Development Committee) and MTESZ (Association of Societies of Technical and Natural Sciences). He was the foundation member and office-bearer of Hungarian Innovation Chamber, etc.

He was the member of Scientific Association of Mechanical Engineering (he was the honorary member of Association since 2011) and Eötvös Loránd Association of Physics (ELFT). He was the foundation member of Hungarian Society of Astronautics (MANT).

Since 1950, he was the member of Hungarian Mining- and Metallurgical Society (OMBKE). He took part in the editing of journal entitled Journal of Mining and Metallurgy – METALLURGY (Bányászati és Kohászati Lapok, KOHÁSZAT) for some years. He was the foundation member and chairman of the former Special Group of Materials Investigation of OMBKE for some years. He was one of the originators and the chief organizer of the biennial or triennial conference entitled *Days of Investigation of Metallurgical Materials (Kohászati Anyagvizsgáló Napok)* having an international reputation at that time.

Research fields: Materials science, materials technology, space materials technology, research-organization, management of industrial innovation.

From the beginning, he played a determining role in organizing the research laboratories of physical metallurgy and materials structure at VASKUT, in advancing the possibilities of experimental physics and in inducing the branch to accept the new research-development approaches based on the materials science. He involved entrants having excellent capabilities in his work with a result influencing favourably the creation of scientific workshops. The interdisciplinary cooperation of intellectual capacities especially the technical research workplaces and workshops of natural science in Hungary was steadily expedited by him. He played an important role in the progressive development of more international cooperation possibilities.

His most significant scientific results obtained mainly in cooperation with his co-workers are as follows: New investigation methods and instruments (e.g. non-destructive metallographic tests, X-ray diffraction methods, 1954-1962); Mathematical simulation of metallographic processes: solidification, homogenization, transformation (1954-1985); Development of new qualification methods and a solution of target-processor following the process (austenitic manganese-steels, malleable cast irons; 1960-1974); The creation and development of a data base for identifying the steels etc.; the initiation and management of program of space-materials technology in the framework of the common Soviet-Hungarian space travelling entitled BEALUCA (1979-1986).

He regularly read papers on Hungarian and international conferences. He published five lecture notes and more than 100 scientific papers mainly in foreign journals. With his co-workers, he invented a lot of patents among others two patents concerning the space-materials technology.

Awards: Employee excellence award of metallurgy (1972), Award of Academy (1974), Sóltz Vilmos Medal (OMBKE, 1979, 1990, 2000 and 2010), Silver Medal of Order of Labour (1980), Golden Medal of Excellent Inventor (1983), Fonó Albert Medal (MANT, 2010), Honoured Member (GTE, 2010), Knight of Cross from the Order of Merit of the Hungarian Republic, Civil Division (20$^{th}$ of August 2011).

His death is a great bereavement for the whole technical society.

**In Memoriam Prof. Dr.mont. Dr.h.c. Hans Eckart Exner**

G. Petzow[1], M. Rettenmayr[2]
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The mission that Prof. Hans Eckart Exner felt, i.e. to understand and communicate structure and properties of materials, entailed that numerous details of his observations on microstructures of materials were placed in larger contexts and found to be basic laws.

Hans Eckart Exner was born on September 2, 1938 in Klagenfurt Austria and grew up in the Austrian Federal State of Steiermark where he went to primary and secondary school. He finished school with the predicate" with distinction "and studied at the University "Montanuniversität Leoben" with the major Metallurgy which had been given a clear focus on Materials Science by the legendary professor Roland Mitsche.

He finished his diploma thesis with the title "magnetic determination of microstructural elements" at age 23 and followed an advice of his academic teacher to take a position as research assistant at the Institute of Metals Research in Stockholm, Sweden. Under the guidance of Prof. Hellmut Fischmeiseter he finished the work on his PhD thesis entitled "Structure and properties of the hard metal WC-10%Co" within only two years. The PhD title was awarded by Montan University Leoben in 1964, again with the predicate" with distinction".

His PhD thesis made Exner acquainted with a field by which he was fascinated throughout his entire career: the microstructure as a scientific phenomenon. All of his scientific efforts somehow comprised thoughts about this phenomenon during his career. It started at Max-Planck-Institute of Metals Research in Stuttgart, Germany and at Stuttgart University (1965-1990) and included activities as Visiting Scholar at Brown University in Providence, RI, USA (1967/68), at University of California, Berkeley (1978) and at the Central Laboratory of IBM in Yorktown Heights (1985). Eckart Exner was appointed Professor for Physical Metallurgy at Darmstadt University of Technology in the newly founded Department "Materials Science" in 1990. He retired from this position in 2003.

During more than two decades of scientific work in Stuttgart, Hans Eckart Exner built up an outstanding scientific competence in several basic fields of materials science. In the beginning he mainly worked on powder metallurgy that challenged his great talent to describe kinetic mechanisms during complex processes. The most remarkable result of this time may be the three-particle-model that allowed a concise and scientifically sound interpretation of observations during sintering of powders that were known empirically for a long time before. The quantitative

description and prediction of density continuities and of the formation of large pores are important examples for the high technological impact of this work. As early as 1970 he quantified and confirmed his results by computer simulation.
In addition to powder metallurgy that he enriched by fundamental findings he also worked on several timely scientific questions. His creative contributions to the modelling of liquid/solid phase transformation like the dendritic solidification of aluminum alloys are well known, and so are his inventive studies concerning the mechanical behaviour of multi-phase materials. By these studies he contributed significantly the understanding of the fracture toughness of hard metals, the strength of sintered and cast materials, the processes during shaping of objects by plastic deformation or metal cutting. Furthermore he carried out important work on the corrosion behavior of copper and magnesium alloys, the nucleation mechanism during internal oxidation and the consequences of the Kirkendall effect leading to failure of electrical contacts on computer chips.

For his experimental studies Hans Eckart Exner involved practically all of the relevant scientific methods. One of his most prominent methods is metallography that he used critically and with virtuosity, starting from problems of preparation, but also including quantitative interpretation of microstructures. Stereology was the field that he mastered like no other scientist of his generation. He introduced this field into Physical Metallurgy and gave incentives to its further development. His books ”Introduction into quantitative microstructure analysis“ and ”Quantitative Image Analysis of Microstructures“ and several contributions to important comprehensive overviews on materials science are standard works in this field.
Soon after joining Max-Planck Institute in Stuttgart, Prof. Exner established ties with Stuttgart University, since it always was one of his concerns to teach. He stayed in the academic field despite tempting job offers from industry and gave courses and lectures at several institutions. In 1990 joined the well-known Darmstadt University of Technology in the Department of Materials Science.
In Darmstadt he could implement his ideas about the education in materials science in the new major ”Materials Science“. His goal to establish both natural and engineering sciences in the materials science education can still be clearly seen in the curriculum and is an important element of materials science in Darmstadt. Besides the course work he advised an impressive number of thesis, particularly approx. 50 diploma theses, 100 PhD thesis and 2 habilitation thesis. He was a teacher in the classic sense, i.e. he did not only provide scientific knowledge to his students, but educated competent scientist and engineers who never forget the theoretical aspects when working experimentally and the practical aspects when working theoretically.
In addition, he got involved in the organisational matters of the department. He acted as Dean of Materials Science, joined several University committees and thus framed the direction and importance of materials science in Darmstadt. His understanding of the University from the Latin origin ”Universitas“, i.e. the collectivity of teachers and students, is visible in his multi-disciplinary scientific work, his discussions and contributions in committees of the departments of biology, architecture, philosophy and civil engineering, as well as in the extensive exchange with the mechanics department.
Prof. Exner’s accomplishments lead to numerous scientific honours and awards. He received an Honorary Doctorate from Miskolc University (Hungary), the Masing Award of the German Materials Research Society, the Henry Clifton Sorby Award of the International Metallographic Society and the Kuczynskis Diploma of the International Institute for the Science of Sintering. He is a Fellow of the Institute of Materials, London, GB, and Honorary Member of the International

Metallographic Society. One of the Awards he particularly cherished is the award that is named after his academic teacher, the Roland-Mitsche-Award that he received in 1998 together with his wife, in appreciation of his contributions in the field of metallographic material's analysis an its circulation in scientific journals.

Hans Eckart Exner deceased on Oct. 14, 2009. By his charisma and openness he had made numerous friends inside and outside of his professional field. The loss of his personality is grievous, but his ideas and approaches are manifest as roots for the following generations and will always be present in the future.

# Organized by

University of Miskolc, Faculty of Materials Science and Engineering, Materials Science Institute
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