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## Final LIMTECH Colloquium and International Symposium on Liquid Metal Technologies

To cite this article: 2017 *IOP Conf. Ser.: Mater. Sci. Eng.* **228** 011001

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Robert Schmitt and Harald Bosse



LIMTECH Alliance

## **Preface: Final LIMTECH Colloquium and International Symposium on Liquid Metal Technologies (LIMTECH) Sept. 19-20, Dresden Germany**

This volume of IOP Conference Series – Materials Science and Engineering represents a selection of contributions presented at the Final LIMTECH Colloquium and International Symposium on Liquid Metal Technologies (LIMTECH) held at Helmholtz-Zentrum Dresden – Rossendorf (Dresden, Germany) on Sept. 19-20, 2017.

Inspired by both the growing societal interest and awareness in energy and resource efficiency and the enhanced measurement and computational capabilities being available nowadays, liquid metal research has recently regained increased attendance. Helmholtz-Zentrum Dresden - Rossendorf (HZDR) and the Karlsruhe Institute of Technology (KIT), both being members of the German Helmholtz Association of Research Centres, therefore took the initiative to synthesize a multi-directional program in order to

- bridge the Helmholtz activities within the Helmholtz energy R&D programs,
- foster collaboration with the knowledge driven university research,
- utilize jointly the infrastructures of Helmholtz centres and universities,
- stimulate collaboration with industrial partners and international research groups,
- enhance talent development in a competitive ambience.

To match the individual interest of the contributing partners and to provide a sustainable perspective for the contributing parties and associations the Helmholtz Alliance LIMTECH bundled the R&D activities on Liquid Metal Technologies (LIMTECH) in a three pillars concept addressing fundamental research aspects, energy and storage applications as well as materials processing activities. These pillars were complemented by a Young Investigators Group (YIG) focusing on measurement techniques for liquid metal flows, a central element of all experiments in the field.

LIMTECH was funded during October 2012 – September 2017 by the German Helmholtz Association. The funding comprised the Helmholtz centres HZDR, KIT, German Aerospace Center (DLR) and Forschungszentrum Jülich (FZJ) and the following German university partners: Technical University Dresden, Technical University Ilmenau, Leibniz University Hannover, TU Bergakademie Freiberg, University of Potsdam – Leibniz Institute for Astrophysics Potsdam, Georg-August University Göttingen, and RWTH Aachen – Access Institute. International partners directly involved were the Institute of Physics Riga (Latvia), the Coventry University (UK) and the company RGS Development B.V. Broek op Langedijk (The Netherlands).

Liquid metal technologies provide a surprising bandwidth in fundamental and applied research. Regarding energy conversion and storage they allow for high-temperature energy conversion, efficient and compact solar power receivers, advanced thermal storage units, new high current density batteries or carbon dioxide free production of hydrogen as chemical energy carrier. In the sense of sustainability and resource efficiency these technologies are of vital importance for the production and casting of steel and light metals, the separation of inclusions and the controlled dispersion of particles in melts for, e.g., new metal matrix nanocomposites or solar-grade silicon. Further on liquid metals are used as targets in modern neutron sources, coolants of fusion and fission reactors but also in advanced laboratory



experiments to investigate the origin and behavior of stellar and planetary phenomena in geo- and astrophysics. Characteristic for LIMTECH was the interlock of experimental and numerical activities in and among the 14 sub-projects additionally supported by the YIG. In addition, the YIG formed the core of a dedicated PhD program, which has been complemented by all research partners. A special focus of the Alliance was on cooperation with industry and the related transfer activities. Worth mentioning as well were the seed grants for which a certain budget was flexibly focused on new ideas and developments. A few of them developed very well up to the level of new projects with new partners.

LIMTECH provided a strong basis for further research projects, e.g. on European level. The international activities were steadily growing. For example, LIMTECH was co-organizer of the 10<sup>th</sup> PAMIR International Conference on Fundamental and Applied MHD held in Cagliari (Italy) on June 20-24, 2016, a leading conference in the field being organized every three years. Of particular interest became the International LIMTECH Young Scientist Award, which was for the first time given in 2016 to Dr. Jiang Wang (Shanghai University, China). In 2017 the winner was Dr. Kaspars Dadzis (Institute of Crystal Growth Berlin, Germany) who presented his award lecture at the present final LIMTECH colloquium.

In summary, the alliance LIMTECH was a very dynamic and successful type of consortium stimulating substantially the national collaboration but to an even larger extent significantly enhanced the visibility and recognition of liquid metal R&D activities in the worldwide community.

The editors would like to thank the authors for their contributions and for their cooperation during the editorial process. We are as well grateful to the reviewers for their constructive criticism and support. On behalf of all LIMTECH members and involved institutions we thank the Helmholtz Association for the substantial funding of LIMTECH during the past 5 years. We sincerely acknowledge the panel members of the initial and mid-term evaluation of our LIMTECH alliance for their constructive comments and hints, as well as the Scientific Advisory Board of the alliance (Prof. J. Etay (Grenoble), Prof. K. Pericleous (London), Dr. W. von Ammon (Ach, Austria)) for their continuous support in the scientific and structural development of LIMTECH during the funding period. Last but not least we are grateful to Dr. Gerd Mutschke who did most of the work for editing the present IOP issue and organizing the final LIMTECH colloquium.

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Colloquium Co-chairs and Co-editors