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MCWASP XIII: International Conference on Modeling of Casting, Welding and Advanced Solidification Processes

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Preface

Due to fast-paced development in computer technologies during the last three decades, computer-based process modeling has become an important tool for the improvement of existing process technologies and the development of new, innovative technologies. With the help of numerical process simulations, complex and costly experimental trials can now be reduced to a minimum. For metallurgical processes in particular, computer simulations are of outstanding importance, as the flow and solidification of molten alloys or the formation of microstructure and defects can hardly be observed experimentally. Corresponding computer simulations allow us inside views into the key process phenomena and so offer great potential for optimization.

In 1980 the conference series 'Modeling of Casting, Welding and Advanced Solidification Processes (MCWASP)' was started up, and has now been continued by holding the 13th international conference on 'Modeling of Casting, Welding and Advanced Solidification Processes', MCWASP XIII, in Schladming, Austria, from June 17–22 2012. Around 200 scientists from industry and academia, coming from 20 countries around the globe attended 78 oral and 50 poster presentations on different aspects of solidification-related modeling topics.

Besides process-related sessions such as (i) Ingot and Shape Casting, (ii) Continuous Casting and Direct Chill Casting, (iii) Directional Solidification and Zone Melting, (iv) Welding, and (v) Centrifugal Casting, a larger focus was put on (vi) Experimental Investigation and In-Situ Observations. In recent years, this topic has been significantly strengthened as advanced synchrotron technologies allow fantastic in-situ observations of phenomena happening inside small metallic samples. These observations will definitely serve as a benchmark for the modeling community. Further macroscopic aspects of advanced solidification science were tackled in the sessions (vii) Electromagnetic Coupling, (viii) Thermomechanics, (ix) Thermodynamics and Solidification Paths, and (x) Prediction of Defects. As microstructure prediction is one of the key disciplines of solidification modeling, sessions such as (x) Meso/Macroscale Modeling of Structure and Segregation, (xi) Formation of Macrosegregation, and (xii) Structure Formation at Microscale were added. Finally some new modeling ideas not being presented in the aforementioned sessions were presented in a small additional session named (xiii) Numerical Methods.

In addition to the new findings obtained by using advanced in-situ observation techniques, significant progress has been made on modeling the formation of microstructures, both at micro and meso/macroscale. Here, three-dimensional simulations of complex situations, e.g. polyphase solidification or grain growth in the presence of melt convection can now be performed quite effectively. However, the community is still challenged when a combined treatment of different phenomena is necessary. Efforts on the numerical description of solid skeleton deformation in combination with (interdendritic) melt flow have just begun. Furthermore, the combination of models for microstructure prediction at the microscale with process models at the macroscale (including melt convection and equiaxed grain motion) is still unsatisfactory. This is also true for combining process models with complex thermodynamics (e.g. for alloys consisting of many solute elements). The dependency of the results on the used numerical scheme, or the fact that the numerical grid might not be fine enough, especially in 3D calculations, are also topics which need

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our future attention. In conclusion, it can be stated that although the community has gained celebrated success over the last decades, we are still challenged by the complexity of the physical phenomena occurring during the solidification of melts.

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