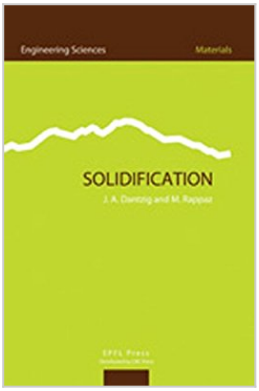

Solidification (Engineering Sciences: Materials)

By Jonathan Dantzig, Michel Rappaz

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Solidification is one of the oldest processes known for producing complex shapes for applications ranging from art to industry, and today it still remains one of the most important commercial technologies for many materials. Since the 1980s, numerous fundamental developments in the understanding of solidification processes and microstructure formation have been derived from both analytical theories and the application of computational techniques using commonly available powerful computers. This book integrates these developments in a comprehensive volume that also presents and places them in the context of more classical theories. Divided into three sections, the text evolves from fundamentals to applications, giving professional engineers and students a firm understanding that they can readily apply.

The first part, *Fundamentals and Macroscale Phenomena*, presents the thermodynamics of solutions and then builds on that subject to motivate and describe equilibrium phase diagrams. Transport phenomena are discussed next, focusing on the issues of most importance to liquid-solid phase transformations, then moving on to describe in detail both analytical and numerical approaches to solving such problems.

The second part, *Microstructure*, employs these fundamental concepts for the treatment of nucleation, dendritic growth, microsegregation, eutectic and peritectic solidication, and microstructure competition. This part concludes with a chapter describing the coupling of macro- and microscopic phenomena in microstructure development.

Defects, the third and final section describes various types of defects that may occur — with emphasis on porosity, hot tearing, and macrosegregation —

presented using the modeling tools and microstructure descriptions developed earlier in the text.

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