In pure aluminum the nucleation of a new solid phase during the liquid-to-solid phase transformation is activated by a relatively large undercooling of the melt with respect to the transformation temperature. The requirement of this undercooling to activate nucleation manifests itself in a large grain size and an inhomogeneous grain morphology, in the solidified material. However, when a solid surface compatible with the lattice of the forming nucleus is present in the melt, less undercooling is needed to activate nucleation. Therefore generally a small fraction of microscopic TiB2 particles (grain refiners) are added to aluminum alloys before solidification. It appears that without the addition of a small amount of extra solute titanium in the melt, the surface of these particles does not work as an effective nucleation site. Even then, only about 1 % of the particles added to the melt nucleate grains during solidification. The remainder are of no inherent value to the final product. Contrary to that, agglomeration of these particles, can results in casting defects in the solidified material. This study provides a new insight into the nature of grain nucleation and growth during solidification of grain refined aluminum alloys and relate the microstructural features to the grain refiner efficiency.
Contents:

- Introduction
- Mechanisms of grain refinement
  - Nucleation
  - Grain growth
  - Overall transformation kinetics
  - Grain refinement models
- Experimental
  - Differential thermal analysis
  - Neutron scattering
  - Three dimensional X-ray diffraction
- Review of experimental results
  - Aluminium
  - Solidification
  - Experiments and results in this thesis
- DTA measurements on aluminum alloys for the investigation of the crystallization kinetics during grain refinement
  - Introduction
  - Sample preparation
  - Experimental method
  - Results and discussion
  - Conclusions
- Solidification of aluminum alloys studied by neutron scattering
  - Experimental study of ordering kinetics in aluminum alloys during solidification
  - Periodic structural fluctuations during the solidification of aluminum alloys studied by neutron diffraction
  - The role of solute titanium and TiB2 particles in the liquid-solid phase transformation of aluminum alloys
  - SANS investigations on the solidification of aluminum alloys
- dimensional X-ray diffraction for grain nucleation and growth
  - Microscopic view on grain nucleation and growth kinetics during solidification of aluminum alloys
  - Evolution of metastable TiAl3 phase
  - Real-time observation of grain nucleation and growth during nucleation and grain growth versus cooling rate
- Summary
- Samenvatting
- Acknowledgements
- Curriculum vitae
- List of publications

ORDER ONLINE AT WWW.IOSPRESS.NL OR FILL IN THIS FORM-
Select the title of your choice and click on order online.

Order form:

IOS Press
Nieuwe Hemweg 6B
1013 BG Amsterdam
The Netherlands
Tel.: +31 20 688 3355
Fax: +31 20 687 0039
E-mail: market@iospress.nl
URL: www.iospress.nl

Gazelle Book Services Ltd
White Cross Mills
Hightown
Lancaster LA1 4XS
United Kingdom
Tel.: +44 1524 68765
Fax: +44 1524 63232
E-mail: sales@gazellebooks.co.uk
URL: www.gazellebooks.co.uk

IOS Press, Inc.
4502 Rachael Manor Drive
Fairfax, VA 22032, USA
Tel.: +1 703 323 5600
Fax: +1 703 323 3668
E-mail: sales@iospress.com

If you would like to order one or more copies of the above, please fill in this order form and send it back to:

IOS Press, Promotion Department, Nieuwe Hemweg 6B, 1013 BG, Amsterdam, The Netherlands.

O I would like to order .... copies of Solidification (US$47 / €40 / £28)

O Please bill me

O Please charge my credit card
O Amer. Express O Euro/Master O Visa

Exp. Date
Card no.

Name:
Address:
City/Zipcode:
Country:
Fax:
E-mail:
Signature:
Date:
Vat no.: