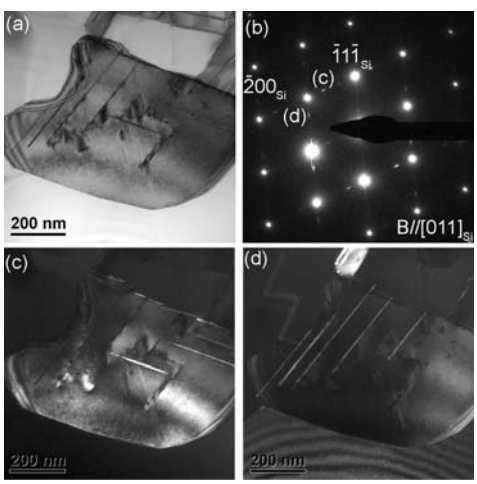
Modification of Al-Si alloys

This investigation is to eluciate the modification mechanism of Al-Si alloys with a trace addition of Sr and rare earth elements.

A series of high purity Al-5 wt. % Si alloys with a trace addition of Sr and rare earth elements (Yb, Y, Sc) were prepared by using arc melting (Left Figure (a)) and subsequent melt spinning (Left Figure (b)). The ribbons were investigated in the as-melt-spun condition and after heating in a power compensated DSC (Perkin-Elmer Diamond). The ribbons for TEM investigation were ion-beam milled using a Gatan Precision Ion Polishing System (Left Figure (c)) and observed using a Philips CM12 microscopy operated at 120 kV (Left Figure (d)).

The addition of Sr into Al-Si based alloys causes a good modification effect to a fibrous morphology. Furthermore, the addition of Sr promotes the formation of the Si precipitates in the supersaturated α-Al matrix and twinning of the Si particles on the grain boundary from the liquid state (Right Figures).

However, the addition of rare earth elements (Yb, Y and Sc) cause a refined plate-like structure, rather than a fibrous morphology. No modified elements were measured within the α-Al matrix and plate-like Si particle. The absence of modified elements inside the eutectic Si may partly explain why no clear Si twinning was observed on {111} Si planes in the eutectic Si.



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ÖGI Österreichisches Gießerei-Institut

Forschungsschwerpunkte:

Solidification principles of metallic materials
Casting technologies of nonferrous alloys
Advanced transmission electron microscopy
Atom probe tomography