

**ABSTRACT FORM**

Block: 1

(2.5 cm)

**RAPIDLY SOLIDIFIED (MELT-SPUN) ALUMINIUM  
ALLOYS: MORPHOLOGY, TEXTURE AND EXCESS**

**VACANCIES.** By P. van Mourik, M. van Rooijen,  
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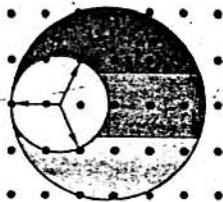
16.5 cm

The morphology and texture of melt-spun AlMg (0-16.45 at% Mg) and AlSi (0-20.23 at% Si) ribbons (25-50  $\mu\text{m}$  thick) were investigated by light microscopy (phase and interference contrast, conical illumination) and X-ray diffraction (Schulz method). After melt-spinning (cooling rate  $10^6$ - $10^7$   $\text{K}\cdot\text{s}^{-1}$ ) it was found by X-ray diffraction that the AlMg alloys were single phase, whereas in the AlSi alloys both a Si-rich phase and an Al-rich phase were found. Generally three zones can be discerned; i.e. starting from the wheel side:

- (i) A chill zone. In the AlSi alloys this zone was featureless. In the AlMg alloys the grain boundaries in this zone were oriented more or less perpendicular to the wheel side and for alloys containing less than 5 at% Mg this zone could not be distinguished.
- (ii) A zone containing relatively long, columnar crystals. These crystals were inclined forward (the angle between the columns and the spinning direction was less than  $90^\circ$ ).
- (iii) A zone of small equiaxed grains. With increasing Si and Mg content an increase of thickness of this zone was observed.

The textures from wheel and upper sides are symmetrical with respect to the longitudinal section of the ribbon, but in general they are not fibre textures. As compared to AlSi alloys, AlMg alloys show sharper textures. The sharpness of the textures decreased in both cases with increasing content of alloying element. At the wheel side (chill zone) a general tendency was found for (111) planes to be aligned parallel to the wheel side. The texture of the intermediate zone was such that simple crystallographic directions (like  $\langle 100 \rangle$ ,  $\langle 110 \rangle$ ,  $\langle 111 \rangle$ ) were tilted with respect to the spinning direction.

12 cm



## ABSTRACT FORM

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This may be related to the inclination of the columnar crystals. The zone of equiaxed crystals was found to possess no texture at all.

The uni-directional heat flow condition in the puddle at the wheel side is believed to be responsible for the columnar structure, while outside the puddle at the top side the different cooling conditions in combination with convection in the liquid metal result in the equiaxed solidification structure.

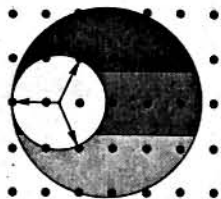
16.5 cm

Rapidly solidified metals generally possess larger amounts of excess vacancies than conventionally quenched metals. As the volume of a vacancy is smaller than that of an atom, annihilation of excess vacancies induces an increase of the average lattice parameter. In all cases the value of the lattice parameters showed a sudden increase on ageing. This increase of the lattice parameter cannot be attributed to precipitation. For the AlSi alloys this follows from precipitation experiments. For the AlMg alloys precipitation results in a *decrease* of the lattice parameter. Furthermore, no diffraction evidence for precipitation was found in the present experiments. Such sudden increase of the lattice parameter did not occur in additional experiments with conventionally quenched AlSi alloys. Therefore we arrive at the following conclusions:

- (i) The increase of the lattice parameter at the start of ageing is caused by excess vacancy annihilation.
- (ii) The amount of excess vacancies strongly increases with the concentration of the alloying element in solid solution.

These results may contribute to the understanding of the precipitation kinetics in rapidly quenched aluminium alloys. Excess vacancy annihilation results in the formation of vacancy loops. These loops may facilitate nucleation and may serve as a source of vacancies to promote precipitation and/or to accommodate misfit between matrix and precipitate.

12 cm



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ENGLISH TRANSLATION OF TITLE

Rapidly solidified (melt-spun) aluminium alloys: morphology, texture and  
excess vacancies.

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1 R A P I D S O L I D I F I C A T I O N

2 M E L T S P I N N I N G

3 E X C E S S V A C A N C I E S

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