

THREE DIMENSIONAL CHARACTERIZATION OF PSEUDO-MICRO TRUSS STRUCTURES IN HIGH PRESSURE DIE CAST AZ91 ALLOYS

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Introduction

- ❖ To understand the strength of hpdc Mg-Al alloys from first principles, it is necessary to identify the contributions¹ of grain size, solute content, and intermetallics.
- ❖ Our previous studies²⁻⁴ have been identified the contributions of solute content and grain size.
- ❖ To find the contribution of intermetallics it is necessary to analyse the volume fraction and distribution of intermetallics in three dimensions.

Objectives

- ❑ Characterization of intermetallics distribution across the cross section in three dimensions.

Materials & Methods

- As received hpdc rectangular tensile cross-section of AZ91 alloy with (LxBxT) of 50x10x5 mm.
- Specimen preparation through mechanical and colloidal silica polishing.
- 2D Intermetallics characterization on glycol etched specimens by using Philips XL30 SEM.
- Serial sectioning on polished cross section by using xT Nova NanoLab 200 DualBeam FIB.
- 3D reconstruction by using Amira® 3D reconstruction software

Results and discussion

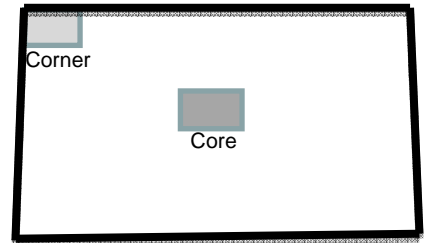


Fig.1 Sites of interest (core and corner) regions in the tensile cross-section for studying the intermetallics distribution in 2D & 3D.

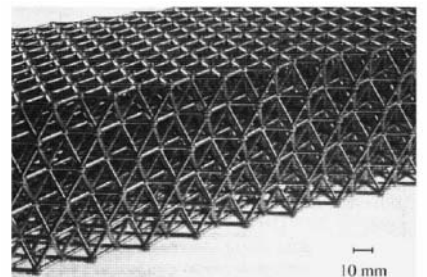


Fig. 2 Micro-truss structure⁵

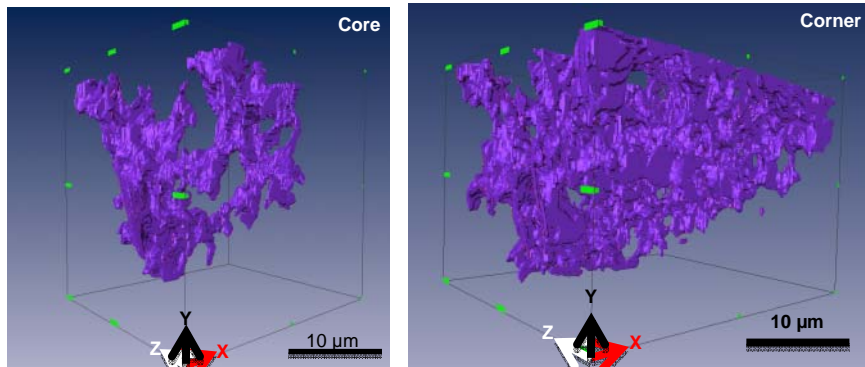


Fig. 3 Three dimensional reconstructed volume of Intermetallics

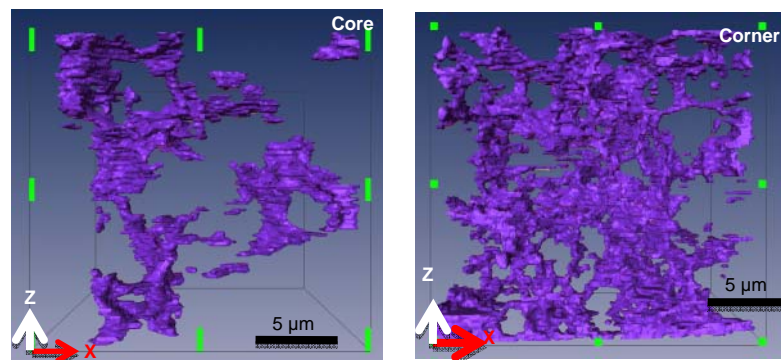


Fig. 4 XZ Views of the 3D reconstructed volume of Intermetallics

Figs. 3 and 4 shows that the intermetallics appear much more densely interconnected, and the overall scale of the interconnected network is much finer in the corner region than in the core region, as observed in 2D SEM images of Fig. 5.

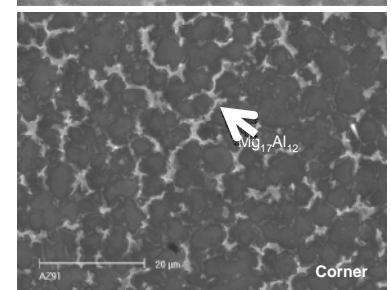
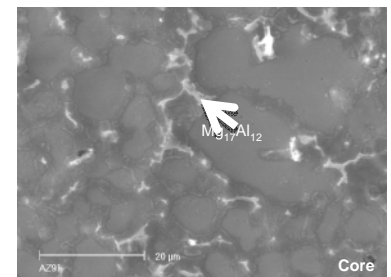


Fig. 5 SEM secondary electron images showing the distribution of intermetallics in two dimensions of the core and corner regions of the tensile cross-section.

Summary

The three dimensional interconnected fine intermetallics network, which is similar to micro-truss structure is observed at the corner region of the tensile cross-section.

References

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