Structure of Coated Voids in Aluminium Alloys

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Voids are fundamental defects in solids. Not only can they have significant effects on the mechanical and electrical properties of materials, but also they present perfect and atomically clean surfaces. Moreover, in materials containing precipitates, such as high-strength aluminium alloys, voids can reflect the structural transformations between precipitate phases [1].

However there is severe lack of knowledge in the structure of voids associated with phase transformations. For example, it was only shown recently that voids in ultra-pure aluminium do not display the equilibrium shape expected from the surface energies of pure aluminium [2]. There is therefore a need to characterise voids locally and at the sub-nanoscale. Scanning transmission electron microscopy (S/TEM) is the ideal technique for such studies.

In this contribution, we present a structural study of voids in a range of aluminium alloys, including Al-Sn and Al-Cu-Sn, using S/TEM imaging and a combination of electron diffraction techniques, in particular, quantitative convergent beam electron diffraction. These voids form as a result of the liquid-to-solid phase transition of Sn precipitates [1]. Figure 1 shows a bright field STEM image of one such void in Al-0.01at%Sn. We focus on the shape, size and surface coating of the voids. This can be achieved by manipulating heat treatment processes, whereby voids can be produced in a variety of morphologies and sizes.

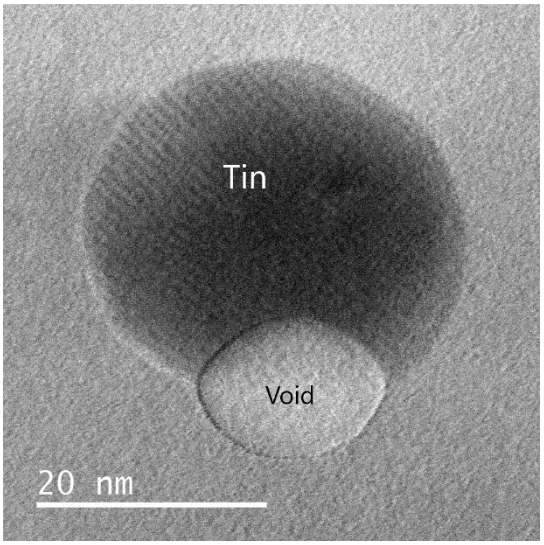

Figure 1: Bright field STEM image of a void in Al-0.01at%Sn that is a result of the liquid-to solid phase transition of Sn precipitates.

Reference

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