Abstract

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Bifilm defects and porosity in Al cast alloys

Liquid Al and Mg-base alloys are so reactive that it is reasonable to assume that the surface layer is always oxidized. If liquid aluminium entered a mould cavity with a velocity greater than a critical value, the surface skin of the liquid metal would fold over onto itself and be submerged into the bulk liquid with a volume of air entrapped within it, creating what is called a bifilm defect. This defect not only acts as a crack but also it is recognized to initiate hydrogen porosity in the solidified casting, which has been found to have detrimental effects on the tensile and fatigue properties of the castings produced. Previous research suggested that during solidification, the hydrogen, in excess of the solubility limit, comes out of the solution and diffuses into the bifilm gap, expanding it into a pore. Also, placing liquid metal in a vacuum may cause its entrained bifilms to expand, enhancing their buoyancy and therefore their floatation to the surface of the melt. In this work, a casting from an A356 Al alloy was allowed to solidify under vacuum. The solidified casting was sectioned into two halves, and the internal surfaces of the pores were investigated using an SEM to determine their relationship with double oxide film defects.