Phase formation and identification by colour metallography in rapidly solidified grey cast iron via drop-tube processing.

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Abstract

Containerless solidification processing remains an uncommon but very effective means of re-engineeringmany alloys microstructure and mechanical properties especially at constant elemental composition. In this study, droplets were produced from as-cast of a conventionally cooled grade 250 BS1450 commercial grey cast iron. The focus here is to explain the mechanism involved in the transformationobserved from the graphite rich α-Fe matrixof the as-cast to retained γ-Fe/Fe_3C in the bigger droplets and finally to α'-Fe in the smaller droplets of the rapidly solidified particles. However, phase identification which is often impossible with standard black and white micrographs is often better revealed by colour metallography. Tint etching procedure wasused todistinguishthe various evolved phases as compared to standard in literatures and the evolvedsamples' morphologies were identified using optical microscopy and SEM while XRD analysis was used to confirm the emerged phases in the various droplet sizes. To that end, Vickers microhardness measurements were performed on the as-cast as well as on the various rapidly cooled samples sizes and the values were found to increase with decreasing droplet diameters. Hence, the progressive change in phase were identified and distinguished based on the combined results from the colour metallography employed, difference in microhardness value obtained and the indexed XRD patterns.

Keywords:
Phase transformation, Colour microstructure, Rapid solidification, Grey iron, Microhardness