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Prediction of the graphite morphology and nodularity based on the quantitative sample solidification cooling curves

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ABSTRACT

Using a combined Quick-Cup for making thermal analysis samples, cooling curves of cast iron were measured for the prediction of the graphite morphology and nodularity by using characteristic points on cooling curve and curve recognition method. The characteristic points include the temperature of eutectic undercooling, TEU, and the temperature of eutectic arrest, TER. Experimental results indicate that there is strong correlation between these two temperatures and the graphite morphology. Graphite is flake-like when TEU is greater than 1140°C and TER is greater than 1153°C. It is compacted with nodularity less than 20% when TEU is in the range of 1130 and 1140°C while as TER is in the range of 1150 and 1153°C. The graphite is mainly spherical, and its nodularity is greater than 80% when TEU is in the range of 1130 and 1140C while as TER is in the range of 1143 and 1150°C. A large number of curling curves are collected, and a database is established. A Curve recognition method is then used. The method uses a comprehensive weighted average deviation of four characteristic points to predict of the graphite morphology. The method is effective in predicting the morphology and microstructure of cast irons using cooling curves measured in a combined Quick-cup.

KEYWORDS: thermal analysis curve, graphite morphology, curve recognition, quantitative analysis