

Master Thesis

Effect of graphite morphology on the thermo-physical properties in cast iron



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Abstract

Cast iron is one of the most used materials in the industry due to its wide properties. Specifically, graphitic cast iron is used in applications where the material is submitted to high temperatures due to its high conductivity and thermal shock resistance. Depending on the graphite morphology, thermal conductivity or mechanical properties can be controlled in graphite cast iron. Spheroidal morphology (SGI) promotes good mechanical properties, while lamellar morphology (LGI) improves thermal conductivity. Graphite can also appear in an intermediate shape, called vermicular (CGI) that presents medium mechanical and thermo-physical properties. Nevertheless, how these properties change when the graphite change from SGI to LGI is still not completely known.

The present work pretends to clarify the relation between thermo-physical properties and the graphite morphology in cast iron, from SGI to LGI. This work uses solidification experiments to control the chemical composition of the alloy, more specifically, the Mg content. At higher content of Mg, the graphite nucleates and grows in nodular shape, at lower Mg content, the graphite appears in lamellar morphology [1, 2]. Once different graphite morphologies are obtained, the thermo-physical properties will be measured.

It was found that nodularity decreases linearly with the time that the alloy stays over the liquidus temperature. Nevertheless, to times longer than 80 min, the nodularity decreases slower, showing, and exponential variation. Thermal conductivity decreases abruptly when the graphite changes from lamellar to 5% of nodularity, then continues decreasing slower when the nodularity increases.

The conductivity of LGI decreases when the temperature increases while to CGI and SGI, the conductivity increases with temperature until it reaches a maximum, then the conductivity starts to decrease. The differences between LGI, CGI, and SGI conductivity shorten as temperature increases.

Keywords

Grey cast iron; LGI; CGI; SGI; thermal conductivity; thermo-physical properties; fading; nodularity; Graphite Cast Iron;

