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Primary grains and eutectic cells in thin wall ductile and compacted graphite iron castings

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This research looks into the most important quality parameters in cast iron, namely the primary grains and eutectic cells in thin walled castings. The primary grains and eutectic cells morphology and count are quality factors reflecting the physicochemical state of liquid cast iron at a given cooling rate. The excellent property combination of thin wall ductile iron (SGI) and compacted graphite iron castings, including thin wall austempered and alloyed iron (eg. ferritic and austenitic SGI) has opened new horizons for cast iron to replace steel castings and forgings in many engineering applications with considerable cost benefits. SGI and CGI should therefore be considered as a potential material for the preparation of light castings with good mechanical and utility properties, the cost of which is relatively low. From the point of view of economics and ecology, thin wall iron castings can compete in terms of mechanical properties with the "light" castings made of aluminum alloy. In the present work, the effect of time spent from spheroidization/vermicularization and inoculation processes on shaping the primary and eutectic structure in thin wall ductile (SGI) and compacted graphite iron (CGI) castings has been shown. A thermal analysis was performed to determine the maximum undercooling at the beginning of the solidification whereas metallographic examinations were carried out to reveal macro and microstructure characteristics during primary and eutectic solidification of cast iron. This work shows that the melt quality can be linked to morphology and number of austenite dendrites (primary grains), graphite and matrix structure (including mechanical properties).

Biography

Marcin Górny, PhD DSc Eng, is an Associate Professor employed at the Faculty of Foundry Engineering, AGH-University of Science and Technology, Krakow, Poland. He is the author of over 100 papers and monography. His research activities are focused in the following areas: a) Cast irons; b) Cast composites, c) Solidification of ferrous and non-ferrous metals and alloys and d) Thin wall castings. As a Principal investigator, he led two research projects on innovative thin-walled ductile and compacted graphite cast iron technology. In 2012, his research activity was awarded by the Institute of Cast Metals Engineers in the form of the British Foundry Medal.

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