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Impact of section thickness on cooling curve morphology, structure and properties of spheroidal graphite cast iron

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Abstract. In the current scenario, the energy crisis is on the continuous rise; researchers and academicians are actively working towards a common goal of energy savings by different means. Spheroidal graphite cast iron (SGI) is one of the major alloys used for automobile and structural applications. Manufacturing industries are more focused on using lightweight components to minimize the overall energy requirements. Nevertheless, the complexity of producing thin-walled SGI products is a challenge. In this study, the solidification cooling curve morphology and microstructure of SGI with varying section/wall thickness are investigated. The results obtained from the simulation of stepbar castings of varying section thickness show that thick sections have longer eutectic reaction thermal arrest due to release of latent heat by the formation of graphite. It is also observed that thin sections have a higher degree of undercooling. Microstructural investigation shows that thin sections have higher hardness and strength due to higher pearlite fraction, but the amount of graphite formed in thin sections is reduced, which could lead to aggravated carbide formation in SGI. Thus it is evident that to avoid the formation of carbides in thin-walled SGI castings more inoculation degree is required to promote graphite formation, which will ultimately suppress carbides precipitation. The results obtained from the cooling curve analysis are in