International Conference on
Contemporary Issues in Engineering,
Agriculture, Applied Sciences and Humanities
(EAH-2019)

Effect of Heat Treatment on Microstructure and Hardness of Ferrito-Pearltic Spheroidal Graphite (SG) Cast Iron

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Abstract—*Ductile iron or SG (Spheroidal graphite) iron remains a material of choice in automobile industry owning to its unparallel favourable features like low cost, excellent castability and mechanical properties. Inoculation and spheriodization treatments are an important part in SG iron production, which improve mechanical and metallurgical properties. S.G Cast iron is an iron-carbon alloy having structure of nodules of graphite embedded in pearlitic and ferritic matrix. These nodules of graphite are formed directly from the liquid during the process of solidification. Graphite structure: It occupies 10-15% volume of total material volume. All the mechanical and physical properties are attributed by the presence of graphite in nodular shape. Graphite amount: As the amount of graphite increases, there is relatively small decrease in strength and elongation, in modulus of elasticity, and in density. Matrix structure: It consists of varying composition of pearlite and ferrite. Section Size: As the section size decreases, Fineness increases. In thinner sections, carbides are present which imparts brittleness and higher nodule count. Composition: Silicon promotes formation of nucleation sites in SG iron.*

In the present work, the effect of quench hardening, normalizing and tempering heat treatment processes on the microstructure and hardness of S.G iron specimen were studied. Various temperatures, quenchants and holding times were used in the present work. The microstructure analysis is carried out using inverted metallurgical microscope and SEM and brinnel hardness is calculated by measuring the indent diameter. Maximum hardness is observed in the quench hardened specimen and the minimum hardness value is observed in tempered (at 450^0C). After quenching, the matrix containing pearlite and ferrite changes to martensite with some retained austenite. Normalizing leads to increase in the pearlite percentage which increases the hardness. On tempering, martensite changes to tempered martensite.

Keywords*: SG iron; Microstructure; Hardness; Quenching; Tempering.*