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SULPHUR – KEY ELEMENT IN GRAPHITE FORMATION IN IRONS
[S in cast irons – friend or enemy? / Demystifying the Role of S in Cast Irons]

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Sulphur is a key element in graphite nucleation in all of cast irons, so optimum sulphur content in the base iron is a prerequisite for each iron type. The effect of sulphur in cast irons varies greatly depending on the presence of Group IIA, IIIB, IVB and III A elements in the periodic table. This research summarizes much of the original data obtained by the present authors on the effects of sulphur in cast irons as well as new, experimental work on the inter-relationships between sulphur with other graphitizing elements [1- 10].

In grey cast irons, excessive sulphur levels can lead to slag inclusions, graphite flake degeneration and affect chill tendency. Sulphur levels less than 0.04% may solidify with high eutectic undercooling, promoting undercooled graphite and/or carbides. In ductile irons, low sulphur levels generally favor reduced nodulizer additions, reduced inclusion formation and result in higher magnesium recovery. However, excessively low sulphur levels may retard or minimize nodular graphite formation. In compacted graphite iron, controlling sulphur and magnesium to tighter ranges involves the aid of sophisticated thermal monitoring software. However, because of concerns regarding future availability of rare earth elements [REE], other production alternatives may be needed. An alternative involves making small and controlled S-addition after Mg-treatment [solo or in combinations with other elements] to promote less eutectic undercooling.

Controlled re-sulphurization with briquetted FeS instead of pyrite powders is the most reliable method for precise sulphur control. Inoculation enhancing through additions of S, O and oxy-sulphides forming elements to commonly used conventional inoculants in a 1:3 ratio, had beneficial effects on solidification of all of standard irons [grey, ductile and compacted graphite irons]. Inoculant consumption was reduced by 50% or more. Using this approach may eliminate the need for rare earth bearing treatment alloys in both nodularizers or/and inoculants.

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