A Contribution to the Understanding of the Combined Effect of Nitrogen and Boron in Grey Cast Iron

Inoculation is an essential part of controlling material properties in grey cast iron. Inoculation practice has for decades been based on the addition to the melt of small amounts of elements with a strong affinity to O (and S) just before casting takes place. This method is proven—both in theory and in practice—to be effective in most cases. But it has the disadvantage that the nucleation effect fades away over time. In particular, in heavy castings (slow cooling) this effect may cause non-uniform and unacceptable material properties in some parts of the casting. Nitrogen is also known to influence grey iron microstructure. Both graphite flake formation and matrix formation are influenced. However, the obtained effects differ considerably between different reported investigations. This investigation deals with the combined effect of nitrogen and boron and how it is possible to utilize this effect to enhance material properties in heavy grey iron castings. It is shown that the controlled additions of nitrogen and boron can be used to control the microstructure of thick section grey iron castings. A plausible theory for the formation of boron nitride nuclei effective for graphite growth is presented.

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