

Alloy Melting Principles

Question

I work in an alloy shop where we use Cr, Ni, and Mo in almost every heat we make. I can't understand how we can "melt" the different alloys in the heat when the melting points are significantly higher than the bath temperature. When I ask some of the people to explain this to me they either say the higher melting point alloy melts due to the formation of a eutectic mix, or the alloy addition is being dissolved in the heat or some answer in between this, which leaves me more confused! Can you explain this?

Thanks, L.H. USA

Answer

The mechanism for dissolution of alloying elements with melting temperatures higher than the temperature of liquid steel is akin to dissolving sugar or salt in water. The additive loses its identity when dissolving in the liquid and its atoms become a solute element (ions in the case of water) so that the original elemental properties are not of import. When the solubility limit of the alloy is reached (say sugar in water, copper in high carbon steel/iron), it will precipitate out as a separate phase, which may be a second liquid or a solid. Similarly, aluminum and silicon precipitate out as inclusions when they react with oxygen dissolved in liquid steel.

The term eutectic was used as a potential explanation for the phenomenon of dissolution of an alloying element with high melting temperature. Yes, up to a certain amount of added element, the "melting" temperature (liquidus) is reduced, but this effect is not related to the question that was raised; this effect only serves to reduce the temperature at which the last drop of liquid becomes solid in the cast section. (This answer was contributed by Peter J. Koros of Koros Associates, email : koros.associates@att.net, phone: +1 (412) 683-2426