Improving Melting Yield
Through Better Furnace Operation

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There have been several studies done on this subject, commissioned by AFS and others, which have shed some light on methods to improve melt yield. One study done by W.M. Nicola and V.L. Richards done as AFS Research, included minimizing oxygen (in air) input into the furnace and the effect of rusty steel scrap, boring briquettes and several pig irons on recovery. They measured slag generation as well as yield, and determined optimum melting methods from trends seen. Certainly increasing the amount of rust on charge materials, the surface area to volume ratio of the charge materials and the amount of slag produced from them can be affected by the furnace operating conditions.

The results, from this actual melting study, showed that melting with a sealed furnace was preferred to using an open furnace, thereby increasing metallic recovery and reducing slag production. (Note that sealing the furnace means to cover the open top with a high temperature ceramic blanket, which drastically reduces heat evolution as well as air introduction.) In addition carbon and silicon recovery were improved over using open top melting furnaces. Even the impact of rust on increasing slag generation and reducing carbon recovery appeared to be significantly negated.

Some other observations were that when using thin steel scrap carbon recovery tended to decrease and slag increased with open melting conditions, probably due to oxidation on heating. This slag became worse when using rusty charge materials. Also carbon recovery was improved as the charge was cleaned up. Charging cast iron boring briquettes produced the highest melt losses, some of which was oil and water counted in the material weight.

This study was not totally conclusive, but showed trends and contributed to the knowledge base about melting. Usually everything that we can do to reduce slag helps the bottom line. This includes decreasing slag handling and disposal costs, reducing the effect of rust and slag on refractories, reducing heat losses and improving metallic yield and carbon recovery. All of this can be easily accomplished by using a cover, which seals the top of the furnace well, thus minimizing air input. This cover can be insulating refractory installed on a good metal cover or ceramic fiber blanket, but in either case they must seal properly.

Other work done on this issue of minimizing oxidation losses was a