IMPURITY REDUCTION IN THE MICROWAVE MELTING AND CASTING OF METALS

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ABSTRACT

As discussed in the companion oral session in the Modeling and Material Interactions, microwave furnaces for the melting and holding of metal melts are energy efficient. But the major attraction is the use of new types of crucibles. Eliminated is the practice of using painted refractory coatings on graphite crucibles. This also eliminates the pre-processing of the painted crucibles, including the health and environmental hazards. Gone are the flaking, spalling, and recoating of graphite crucibles. By using the advantage of microwave heating, sintered ceramic crucibles are significantly less prone to these problems leading to inclusions and carbide reactions.

Microwaves can penetrate and heat various ceramics to very high temperatures. Superheating (T > Tmelt) is easily accomplished which facilitates thin castings. With significantly fewer inclusions, better structural properties and fewer blemishes are expected.

Certain ceramics do not wet or chemically react with the metal. Microwave heating, can provide a very uniform and rapid heating of certain ceramics with significantly lower thermal stress than furnaces based on infra-red. Ceramic heating cannot be accomplished by induction heating either.

Simple dud melts (cast mold= holding crucible) of aluminum or copper melt were highlighted by the ease of cold metal removal by merely turning the crucible over and letting the metal slip out. This is due to the non-wetting nature of specific ceramic crucibles. Proper selection and handling of crucible material for the metal will permit numerous reheats.

Furthermore, an inert cover gas or vacuum may be controlled to further reduce interactions. This reduces slag or dross formation.