S-BAND MICROWAVE PROCESSING SYSTEM FOR MELTING TITANIUM POWDER COMPACTS*

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The emerging reduction technologies for titanium from ore produce powder instead of sponge. The processing of titanium powder by conventional methods is energy intensive. Titanium acts as a getter for oxygen and tends to react with many materials at the high melt temperature (melting point: 1675 °C). Most melts conventionally require high vacuum, 10^{-6} Torr or better. Plasma arcs have the additional problem of electrode consumption, and direct induction heating of the titanium powder is problematic. Microwave melting in an inert gas environment is potentially energy efficient due to the possibility of direct microwave heating of the titanium powder augmented by hybrid heating. A robust S-Band microwave system has been developed for melting titanium powder compacts up to few hundred grams in mass. The titanium powder compacts are heated to temperatures up to 1800°C in an over-moded cylindrical cavity with a flowing argon gas atmosphere. Microwaves from a 6 kW Cober S6F industrial microwave generator are injected along the cavity axis and a 3-stub tuner is used to optimize coupling efficiency. The compact is contained in a ceramic crucible surrounded by an insulating casket. Plasma formation during processing has been observed, produced by either breakdown of the argon atmosphere (blue light emission) or by titanium vapor reacting with residual oxygen (yellow light emission). The experimental setup and the results of melting and sintering experiments will be described.

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