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Pressure Casting of Refractory Ceramics*

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A METHOD for has been recently developed by Ryan and Peters[1] for pressure casting refractory metal alloys. A button arc melter is modified to permit chill casting of rods by creating a pressure differential between the arc melter atmosphere and an evacuated quartz tube which is dipped into the molten button. We have extended this technique to the casting of arc melted ceramics, in particular titanium monoxide (melting point 1750°C); but find that quartz tubes are not suitable because they generally shatter on cooling, at the same time cracking the cast TiO rod into many small pieces. Although the TiO does not wet quartz, the fracturing glass simultaneously causes the brittle ceramic material to shatter. For more ductile materials, such as metal alloys,[1] destruction of the quartz mold presents no great problem. In attempts to circumvent this problem, we unsuccessfully tried graphite lubricants, different tube diameters and geometries, and tantulum tubing. The metal tubing did not fracture; however it was easily wetted by the molten oxide.

We have been successful in casting ceramics by using a tube machined from graphite[2] instead of quartz. Experiments so far indicate that this material allows the pressure casting of brittle ceramics in a routine and reproducible manner. The graphite tube is machined from solid rod. Its upper end mates with a ground stainless steel joint and tube which passes through a movable ball joint vacuum seal on top of the arc melter.[3] Because the graphite has higher thermal conductivity and maintains its strength at high temperatures, it withstands thermal shocks introduced by rapid temperature changes yet is not wetted by the molten ceramic.

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[1] J. J. Ryan and E. T. Peters, Rev. Sci. Instr. **36**, 209 (1965).
[2] Graphite type E821 supplied by the National Carbon Co.
[3] M.R.C. Manufacturing Corp. model V4-120 ball and socket vacuum seal.