Corrosion-Resistant Container for Molten-Material Processing

A combination of materials functions and survives in hot, corrosive environments.

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In a carbothermal process, gaseous methane is passed over molten regolith, which is heated past its melting point to a temperature in excess of 1,625 °C. At this temperature, materials in contact with the molten regolith (or regolith simulant) corrode and lose their structural properties. As a result, fabricating a crucible to hold the molten material and providing a method of contact heating have been problematic.

Alternative containment approaches use a large crucible and limit the heat zone of the material being processed, which is inefficient because of volume and mass constraints. Alternative heating approaches use non-contact heating, such as by laser or concentrated solar energy, which can be inefficient in transferring heat and thus require higher power heat sources to accomplish processing.

The innovation is a combination of materials, with a substrate material having high structural strength and stiffness and high-temperature capability, and a coating material with a high corrosion resistance and high-temperature capa-