Developing Casting and Quenching Systems for Flammable-Reactive Metals

Abstract

At high temperature, some metals require special procedures due to their high flammability, reactivity, and/or decomposition. The current methods are proportionally expensive and don’t achieve optimum outcomes. The developed systems in this study tend to reduce the processing cost defects and attain alloys with optimum properties with high consideration to safety.

Goals

- Producing a safe and efficient system
- Reducing the processing defects to attain alloys with optimum properties
- Reducing the manufacturing cost

Objectives

- Reducing the interaction with environment by using closed system
- Reducing the oxidation by using inert gas
- Reducing the decomposition rate by using positive pressure
- Reducing the inclusions micro segregation and increasing the mechanical properties by using rapid solidification

The designed Systems

The melting system was designed as a closed system, and it consists of:
- Tube furnace
- Ports to inserting the sample from the top and retrieve it from the bottom
- Inlets and outlets for pressure control

The quenching system consists of:
- Cylinder open from the top and inserted into closed-end disc
- Inlets and outlets for gas and air control

Outcomes

- The developed procedure led to an optimal final casting
- Reduced the evaporation rate significantly
- Eliminated the porosity and inclusion
- The cost was decreased with using closed-controlled system with high safety consideration
- Refined the structure and improved the properties by quenching

References


Kim, Sang-Woo; Kim, Do-Hyun; You, Byung-Dae; Han, Jeong-Whi; Kim, Min-Soon. Source. "Evaporation behavior of magnesium under reduced pressure". Materials Science Forum, 2003, v 439, p 238-245.