Case Study

Rotary Melt Spinning Machine

Description

A machine was required for the production of micron thin strip/foil material by rapid quenching of 1600 deg C melt on a rotating copper disc.

Crucible & Heater

Open Chamber with Rotor

This was to be a research machine, processing 100 gm samples, partly based on a previous design. The machine consisted of a 600 mm dia, stainless steel, high vacuum chamber with a large sealed front door, in which rotates a 300 mm dia copper disc at approximately 3000 RPM. This was driven via a 1:1 vee-belt arrangement through a high vacuum seal assembly. The drive shaft was supported externally by a precision bearing and internally by a bearing inside the seal itself. A high precision, keyless taper locking device was used to centralise and attache the copper disc to the main drive shaft, since this would need to be re-balanced or replaced on a fairly regular basis, due to wear.

Positioned at TDC of the wheel was an adjustable crucible and nozzle system with integrated thermocouple. The nozzle position was adjustable vertically via vacuum sealed, high precision micro movement device and bearing system. It was also manually adjustable in the horizontal direction. An induction heating coil was wound around the base of the removable crucible/nozzle.

At approximately the 4 o'clock position, an adjustable gas knife assembly and scrapper was mounted to aid the release of processed material from the disc into the collection area. Various viewing ports were then located around the main pressure vessel chamber.

Finally, the complete vacuum chamber assembly, drive motor, vacuum pump, high voltage power supplies and control cabinets were mounted on a robust/compact fabricated steel framework.

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Disciplines Used

- Conceptual & Mechanical Design
- Computational Fluid Dynamics
- Rotordynamics Analysis,
- Stress & Vibration Analysis