Isothermal Processing Vessel

Aavid, Thermal Division of Boyd Corporation's Isothermal Processing Vessel (IPV) (Figure 1) eliminates hot or cold zones on reactor walls, increases product yields, and eliminates undesirable by-products.

The IPV is an extension of the Isothermal Furnace Liner (IFL), which has been supplied to semi-conductor crystal growers and calibration laboratories since 1971. The IFL is an annular liquid metal heat pipe that provides a uniform temperature working environment. Measured spatial temperature variation in an IFL is less than 10 mK and may, in many cases, exceed the sensitivity of available measurement techniques.

Differences Between an IPV and IFL

The IPV combines the IFL heat pipe technology with more advanced vessel design. Small vessels can provide the same temperature uniformity as IFLs, while large vessels maintain temperature within 0.5º C. The IPV is a custom designed vessel, which is fabricated to specific size, configuration, containment, and temperature requirements. Size and configuration can vary between small diameter long tube flow reactors and large diameter batch or stirred tank reactors. The isothermalizing operation of the heat pipe is completely passive, requires no user servicing, and operates indefinitely.

How an IFL Operates

Heat pipes achieve temperature uniformity by continuous evaporation and condensation of a working fluid sealed within an annular space. Since the working fluid is in a two-phase equilibrium with its own vapor, all wetted surfaces are isothermal. In the IPV, the annular heat pipe forms the vessel surrounding the working reactor volume. The isothermalizing heat pipe is hermetically sealed, and separates the working fluid from the inner reactor working volume, and the outside ambient environment.

Materials of construction for IPV are typically stainless steel or Inconel, but other materials are possible. The desired operating temperature range will determine which working fluid is used.

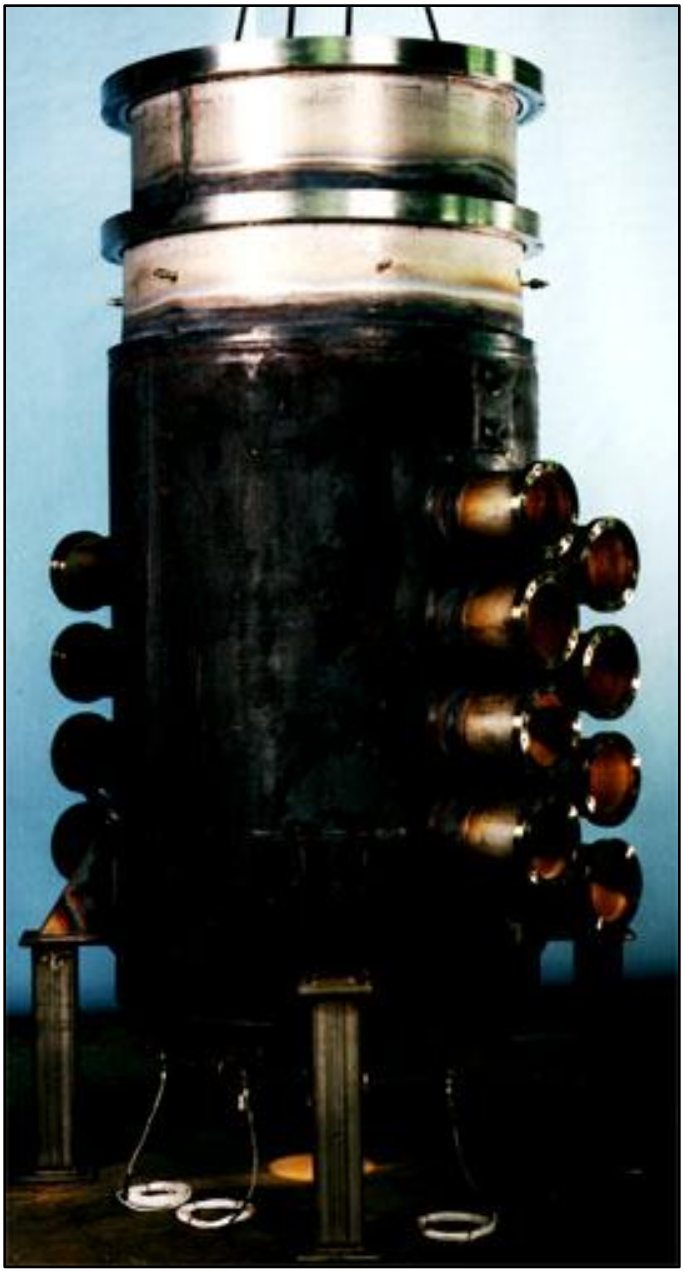

Figure 1 – Isothermal Processing Vessel

Working Fluid Options:

- Water: 20º to 300º C
- Cesium: 300º to 600º C
- Potassium: 400º to 1000º C
- Sodium: 500º to 1100º C
- Lithium: 900º to 1600º C

Key Features and Benefits

- Uniform Surface Temperature
- Optimum Reaction Rates
- Higher Yields and Product Purity
- Cost Savings through Higher Feed Stock Conversion
- Low Operating Costs
- Same Product Life as Conventional Reactors
- Passive, Vibration-Free Operation