Sealing Glasses for Electronic, Optical and Biomedical Packages

Inorganic glasses and cements are used to manufacture hermetic packages

- Hermeticity ensures reliability
  - Avoid out-gassing/deterioration of organic sealants
- Sealing materials must possess a range of engineering properties
  - Thermal expansion matches to substrates
  - Thermochemical compatibility with substrates and in application environments
  - Electrical resistivity
  - Desired optical characteristics
- UMR is developing glasses and cements for a variety of applications

Problem: Conventional black enamels used for windshield trim typically contain up to 30% PbO.

Challenge: Develop new PbO-free formulations with requisite thermal (low processing temperatures, expansion match to window glass) and chemical characteristics (durability, strong chemical bonds to window).

Approach: Modify iron phosphate glass formulations.

- Originally developed at UMR for nuclear waste encapsulation.

Enamel-coated test coupons have been fabricated and black, well-adhered coatings are possible.

Challenge: Develop bio-compatible coating for titanium implants.

We Have Characterized a Range of Candidate Sealing Materials

Compositions have desirable properties:
- Thermal expansion match to Ti
- Hermeticity ensures reliability

Clibing materials must possess a range of expansion match to window glass)

Boundary Coated Test Coupons have been fabricated and black, well-adhered coatings are possible.

Developing Sealing Materials for Solid Oxide Fuel Cells

Problem: Develop hermetic sealing materials to separate fuel and oxidants.
- Thermal compatibility with a variety of materials
- Stringent operational conditions
- Elevated operational temperatures (>700°C)
- Long times (>10,000 hrs)
- Oxidizing/reducing conditions

Approach: Develop and characterize novel silicate glass-ceramic systems

Cell Components
- Anode: Nickel/YSZ
- Electrolyte: Y-stabilized Zirconia (YSZ)
- Cathode: Doped LaMnO3
- Interconnect material: Cr-steels, conducting oxides

Optoelectronic Packaging

Leadless Chip Carrier (LLC)

Materials for Hermetic Seals

Challenge - Special requirements
- No outgassing
- Non-metallic

Epoxies eliminated due to outgassing
Solder and metallization eliminated
Consider low temperature lead-based glasses
Develop impervious hydrated-bond cements

For further information contact Richard Brow (brow@umr.edu)