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GLASS-TO-METAL SEAL DEVELOPMENT USING FINITE ELEMENT ANALYSIS: STRESS MEASUREMENTS IN MODEL SAMPLES AND CORRELATION TO ANALYSIS, Rajan Tandon*, Materials Reliability; Michael K. Neilsen, Applied Mechanics Development, Sandia National Laboratories, Albuquerque, NM 87815

Glass-to-metal (GTM) seals maintain hermeticity while passing electrical signals between two environments. Many GTM seals contain a metal (A) shell, an enclosed insulator (glass), and usually a different metal (B) pin for making electrical contact. In compression GTM seals, the materials chosen are such that the shell thermal expansion coefficient is greater than that of the glass, thereby placing the glass in compression upon cooling from the processing temperature (~700°-1000° C). Accurate finite element analysis (FEA) of seal forming requires that the model possesses adequate mesh refinement, and that constitutive models/parameters capture the important thermal-mechanical characteristics of materials.

A standard compression-seal material set is metal A=stainless steel 304, metal B= Alloy 52, glass=Schott S-8061. However, these seals sometimes exhibit extensive cracking in the glass around the pins. To understand seal materials behavior, model samples, comprised of glass enclosed by the steel shell, were fabricated. The stresses in ~100 μm^3 volume were measured at different locations in the glass using a Vickers' indentation technique. The stresses in the glass close to the steel shell were ~30-40 MPa tension. These stresses are sufficient to cause cracking in the glass, even in the absence of the pin. Refined mesh sizes, far smaller than typically used, were necessary for the FEA to reproduce the experimental results. The FEA results did not converge with mesh refinement indicating that there is a weak singularity in the stress field near the interface. The implications of our results for modeling such multi-material components are discussed.

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ORAL PRESENTATION

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