Innovative Synthesis of Glass Materials for Electronic Packaging Applications

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The collaboration between the Pennsylvania State University and the National Taipei University of Technology in Taiwan primarily focuses on the development of high-density borosilicate glass for advanced electronic packaging applications through a liquid-phase sintering processing. The project aims to explore the structure-properties-processing relationships of B_2O_3-SiO_2 composites, with a focus on optimizing the dielectric, thermal, and mechanical properties of the glass. By emphasizing the role of glass microstructure and investigating how the dielectric constant, loss, and thermal conductivity are influenced by the material's composition and processing conditions. Effective medium theories will be applied to predict and tailor the dielectric properties of the glass composites, while liquid-phase sintering techniques will be optimized to achieve a fully amorphous, high-density glass with minimal porosity and controlled grain growth. Advanced characterization techniques, including SEM, TEM, FTIR, XRD, and DSC, will be employed to assess the microstructure and properties of the sintered glass. The expected outcome is a high-density borosilicate glass with a low dielectric constant, high thermal stability, and improved mechanical integrity, suitable for next-generation communication devices and high-frequency electronic circuits.