European Society of Glass – Physics of Non-Crystalline Solids (ESG-PNCS) – St. Malo, FRANCE 8-12 July 2018

Advances in infrared optics: novel materials towards next-generation components and devices

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Abstract

Novel optical materials capable of advanced functionality across the infrared will enable optical designs that can offer light-weight or small footprint solutions in both planar and bulk optical systems. UCF's *Glass Processing and Characterization Laboratory (GPCL)* and our collaborators have been evaluating compositional design and processing strategies for both bulk and film solutions employing multi-component chalcogenide glasses (ChGs). These materials can be processed with broad compositional flexibility that allows tailoring of their transmission window, physical and optical properties, allowing them to be engineered for compatibility with other homogeneous amorphous or crystalline optical components or in the case of planar photonic applications, underlying substrates. Specific examples of this strategy demonstrated for solution-derived ChG layers for gradient refractive index (GRIN) and extended to applications as phase change materials (PCMs), poled ChGs with gradient compositional and surface reactivity behavior, nanocomposite bulk ChGs and glass ceramics, and metalens structures realized through direct laser manufacturing (DLM) of ChGs are discussed. Limitations and opportunities of these strategies within these applications, are reviewed.