Chalcogenide glasses (ChG) are known for their wide transmission ranges in the infrared and for their high refractive indices. However, applications for ChG are often limited by their poor thermal/mechanical properties. Precipitating a secondary crystalline phase in the glass matrix can improve these properties, but too much crystallization and/or large or multiple phase crystallites can lead to a loss in transmission. Controlled crystallization can be used to tune the properties of these glasses. This effort has examined the crystallization behavior in phase separated chalcogenide glasses in the GeSe$_2$â€“As$_2$Se$_3$â€“PbSe glass system. The research focused on two glass compositions with dropletâ€“matrix morphology, where the Pbâ€“rich, high crystallization rate phase was present as Pbâ€“rich droplets or as a Pbâ€“rich matrix. The nucleation and growth behavior was characterized in order to develop heat treatments to produce glassâ€“ceramics. The evolution of properties as a function of heat treatment was tracked in order to get a good understanding of where adverse properties (e.g. loss in transmission) of the glassâ€“ceramic outweigh the beneficial properties (e.g. increased mechanical strength and refractive index). The impact of parent glass morphology and the role of the dominant phase on these properties has been correlated to the starting and final glass/glassâ€“ceramic morphology.

Major: Materials Science and Engineering

Educational Career:
Bachelor's of Ceramic and Materials Engineering, BS, 2013, Clemson University

Committee in Charge:
Kathleen Richardson, Chair, CREOL/Department of Materials Science and Engineering
Romain Gaume, CREOL/Department of Materials Science and Engineering
Yongho Sohn, Department of Materials Science and Engineering

Approved for distribution by Kathleen Richardson, Committee Chair, on June 8, 2016.

The public is welcome to attend.