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Title: Measurement of chalcogenide glass optical dispersion using a mid-infrared prism coupler

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Abstract

Chalcogenide glass development continues to be the source of intense study by research groups around the world. Their physical properties, including broadband infrared transparency, high refractive index, low glass transition temperature, and nonlinear properties, make chalcogenide materials attractive candidates for advanced mid-infrared (3 to 12 μm) optical designs. Efforts focused at developing new chalcogenide glass formulations and processing methods require rapid quantitative evaluation of their optical constants to guide the materials research. However, characterization of important optical parameters such as optical dispersion and thermal index variations (dn/dT) remains a slow and costly process, generally with limited accuracy. The recent development of a prism coupler at the Pacific Northwest National Laboratory (PNNL) now enables rapid, high precision measurement of refractive indices at discrete wavelengths from the visible to the mid-infrared. Optical dispersion data of several chalcogenide glass families were collected using this method. Variations in the optical dispersion were correlated to glass composition and then compared against minimum deviation measurements. While this work has been focused on chalcogenide glass synthesis, mid-infrared prism coupler analysis has broader applications to other mid-infrared optical material development efforts, including oxide glasses and crystalline materials.

100 Word Summary:

Chalcogenide glass development continues to be the source of intense study by research groups around the world. Their physical properties, including broadband infrared transparency, high refractive index, low glass transition temperature, and nonlinear properties, make chalcogenide materials attractive candidates for advanced mid-infrared (3 to 12 μm) optical designs. Efforts focused at developing new chalcogenide glass formulations and processing methods require rapid quantitative evaluation of their optical constants to guide the materials research. The recent development of a mid-infrared prism coupler now enables rapid, high precision measurement of refractive indices at discrete wavelengths from the visible to the mid-infrared.