American Ceramic Society

View Abstract

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CURRENT SYMPOSIUM: S6 - Complex Oxide and Chalcogenide Semiconductors: Research and Applications

CURRENT SESSION: Applications in next-generation technology

PRESENTATION TYPE: Invited (by Invitation Only)

TITLE: Chalcogenide Materials and Applications: From bulk to 2D

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ABSTRACT BODY:

Abstract Body: In this talk, we give an overview of our chalcogenide material and device capabilities and the applications they are driving, scaling from bulk glasses to two-dimensional films. Using a melt-quench technique, we routinely manufacture a family of Ga:La:S semiconducting glasses which offer considerable advantages over commercially available chalcogenides, expanding uses in defense, medical and sensing. We use these glasses to produce optical fibers using extrusion, rod and crucible drawing. We are also developing these materials further, for example by incorporating selenium resulting in improved infrared transmission, enabling both thermal and visible imaging for object recognition.

Transition metal dichalcogenides (TMDCs) are promising alternatives to graphene, with bandgaps tunable through composition and number of layers. Today's challenge remains in the fabrication of large area atomically thin TMDCs on desired substrates. We have developed chemical vapor and atomic layer deposition techniques to deposit highly crystalline TMDCs, from nanometers down to a monolayer on up to 6 inch wafers. We recently developed novel patterning techniques that result in defect free devices. Our applications range from 3D photonic crystals to photovoltaics and transistors.

Finally we deposit chalcogenide thin films via sputtering and demonstrate applications which exploit their phase change and thermoelectric properties.

KEYWORDS: TMDCs, Ga:La:S, thermoelectric, FETs, CVD, ALD.