14:30 **Growth and characterization of high resistivity $AgGaSe_2$ single crystals**

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Ternary chalcopyrites with composition I-III-VI_2 are known non-linear optical materials in the infrared region. $AgGaSe_2$ is an important material for non-linear applications in the chalcopyrite family. However, this material was not explored enough for semiconductor applications. Undoped $AgGaSe_2$ crystals reported to grow with high resistivity (10^9 ohm-cm). In this present investigation we report growth of high resistive $AgGaSe_2$ single crystals by vertical Bridgman technique. The crystals were characterized by IR transmission microscopy, optical absorption, micro-Raman and photoluminescence spectroscopy (PL) and correlated to compositional variation along the growth direction as measured by energy dispersive X-ray spectroscopy. The transmission of the as-grown crystal was in the 60-65% range. The highest resistivity obtained was 10^{11} ohm-cm and the material was found to be highly photoconductive.

14:45 **Study on the growth of ZnGeP2 single crystal**

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State Key Laboratory of Crystal Materials, Shandong University, Jinan, 250100, P. R. China

Zinc Germanium Phosphide(ZGP) is good mid-IR NLO materials for laser frequency conversion and transmission rage of ZGP is from 0.7-12μm. It is has high nonlinear optical coefficient (d14=75pm/V) and thermal conductivity(0.35W/cm·K) as well as lower absorption coefficient in near-infrared range. ZGP has been a lower laser damage threshold in past time owing to the crystal quality. It's damage threshold has been increased by the improvement growth method. The synthesis of ZGP poly-crystal materials is the important step for growth ZGP single crystals. P Ge Zn elements were used to synthesis ZGP poly-crystals, the conditions has been investigated. This method can be avoid explode of quartz tube and P Ge Zn ratio in ZGP. The improvable bridgeman method is used to grow single crystal. ZGP single crystal can be grown from low temperature gradient and grow rate.

ACCGE Industrial Crystal Growth I
Session Chair: Bill Bonner
Room: Gallatin
Monday (July 11) 1:30 - 3:00 pm

13:30 **From MgO to Actinides to Stainless Steel – Crystal Growth at Oak Ridge National Laboratory (INVITED)**

Lynn A. Boatner
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The importance of high-quality, well-characterized single crystals for use in both basic research and applied development activities was clearly recognized very early in the history of Oak Ridge National Laboratory (ORNL). While the specific single-crystal materials of interest have changed (and often dramatically) over time, single-crystal growth remains a strong component of the ongoing condensed matter and materials science research at ORNL. The early research at ORNL was distinguished by the growth of highly perfect single crystals of copper that were used in pioneering studies of radiation damage effects and defects in solids as well as subsequent surface science investigations. Somewhat later, electron beam float zone methods were used to grow single crystals of high-purity metals and alloys that were used in studies of superconductivity and the properties of high-purity metals. The ORNL crystal growth capabilities have encompassed almost every growth method - with the exception of flame-fusion techniques. They have included some relatively unique aspects such as the ability to grow single crystals of highly radioactive materials – including halide and oxide crystals doped with actinide elements such as curium, americium, berkelium, einsteinium, etc. Researchers at ORNL were early practitioners of the growth of single crystals of refractory oxides such as MgO, CaO, and SrO by means of the submerged-arc-fusion technique. The resulting oxide crystals formed the basis for a long series of fundamental and applied investigations and eventually provided the basis for a Cooperative Research and Development Agreement with a U. S. crystal growth company. Included among some of the more unusual crystal growth endeavors is the growth of single crystals of a ternary Fe-Ni-Cr alloy that is an analog of 300-series stainless steels. These stainless steel single crystals were utilized in pioneering studies of welding phenomena and solidification microstructures. Current crystal-growth research at ORNL is concentrated on the growth of ferroelectrics, new substrate materials for thin-film and super-lattice growth, oxide semiconductors such as ZnO and tin dioxide, conducting oxides for use in photoelectrochemical cells for hydrogen production, phosphates for gamma-ray scintillator and phosphor applications, and crystals of exotic correlated electron materials. Single crystals grown at ORNL over a time span of more than 50 years provided the initial foundation for what has eventually grown into the AACG single crystal growth collection that is publicly displayed at a variety of venues. The past and present varied and diverse crystal growth activities at ORNL will be reviewed along with the current status of the AACG crystal growth collection.

14:00 **HOW TO START YOUR CRYSTAL GROWTH (INVITED)**