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Pulsed laser deposition of ZnS_xSe_{1-x} and its integration into multilayered Cr^{2+}:ZnSe structures for mid-IR electroluminescence[1] Z.R. LINDSEY, M.W. RHOADES, V.V. FEDOROV, S.B. MIROV, R.P. CAMATA, University of Alabama at Birmingham — Transition metal-doped II-VI semiconductor thin films have shown to be promising materials for mid-infrared (mid-IR) laser sources. When ZnSe is doped with transition metal ions such as Cr^{2+}, the resulting broad emission characteristics in the 2-3 micron spectral range indicate potential for tunable lasing in the mid-IR. However, the incorporation of Cr^{2+} into the ZnSe lattice greatly decreases the conductivity of the material, which presents challenges for potential electroluminescence and device applications. A major goal of this work is to demonstrate electron flow through the optically active material by utilizing ultrathin Cr^{2+}:ZnSe sandwiched between conductive high-quality ZnSe-based layers. A p-n junction surrounding the Cr^{2+}:ZnSe layer is formed by pulsed laser deposition of the ternary alloy, ZnS_xSe_{1-x}, doped with appropriate n-type and p-type dopants, where the compositional parameter, x, is varied within the range x=0.02-0.10. Several films were deposited at varying growth temperatures and with various compositional parameters, and then analyzed via x-ray diffraction, scanning electron microscopy, and Raman spectroscopy to investigate and optimize the crystal quality of the alloy for device integration. An interesting growth regime is identified at a laser fluence of 1.8 J/cm^2 and substrate temperature of 425C where polycrystalline $ZnS_{0.06}Se_{0.94}$ grows on GaAs substrates with the (311) direction of the grains preferentially aligned along the direction normal to the substrate.

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Z.R. Lindsey
University of Alabama at Birmingham

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