Abstract Submitted
for the SES15 Meeting of
The American Physical Society

Carrier Concentration Control for n-Type Conductivity in Mid-Infrared Active Cr2+:ZnSe Thin Film Structures MATTHEW RHOADES, ZACHARY LINDSEY, VLADIMIR FEDOROV, SERGEY MIROV, RENATO CAMATA, Univ of Alabama - Birmingham — Mid-infrared (IR) stimulated emission under optical excitation has been demonstrated in chromium doped zinc selenide (Cr2+:ZnSe) thin films. Achieving this in an electrically excited structure would have numerous applications. This goal requires careful control of carrier concentration (ND) in the n-type and p-type layers adjacent to the mid-IR optically active material, which is made difficult by the highly insulating characteristics of Cr2+:ZnSe. In this work thin films of chlorine doped zinc selenide (Cl:ZnSe) are fabricated with pulsed laser deposition (PLD) to function as n-type cladding layers in a heterostructure for mid-IR electroluminescence. An effective n-type doping of ZnSe is achieved by varying the mass ratio of zinc chloride (ZnCl2) to ZnSe precursors in the starting pressed powder targets. Appropriate stoichiometric mixtures allow for the control of the ND in the Cl:ZnSe targets that are used to produce thin films on gallium arsenide substrates by PLD. Impedance spectroscopy, specifically the Mott-Schottky measurement, is used to determine the ND of the fabricated thin film samples. We will discuss the observed correlation between ND determined from the stoichiometric mixtures of ZnCl2 to ZnSe and the measured ND in post-PLD thin films. This will allow for ND to be controlled in Cl:ZnSe thin films to be used as n-type layers in Cr2+:ZnSe structures capable of electrically pumped mid-IR stimulated emission.

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Date submitted: 16 Oct 2015 Electronic form version 1.4