

Abstract Submitted
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Structural, magnetic and electronic properties of chrome-doped indium oxide for negative index optics¹ MARK HICKEY², ADIL-GERAI KUSSOW³, ALKIM AKYURTLU⁴, University of Massachusetts — The study of negative refractive index has almost become almost synonymous with metamaterials comprising composites of metals and dielectrics. These inhomogeneous systems suffer from high losses and are limited in their scope of application due to the macroscopic nature of their fabrication. We focus on homogeneous materials of single crystals based on indium oxide, grown by molecular beam epitaxy. We identify all of the cubic bixbyite X-ray diffraction peaks in this high quality material and verify the stoichiometry with energy dispersive X-ray scattering. We have achieved carrier concentrations of $\sim 3.5 \times 10^{18} \text{ cm}^{-3}$ and band gaps in the range $\sim 3.2 \text{ eV}$ in our intrinsic films at room temperature. Our Cr-doped indium oxide $\text{In}_{2-x}\text{Cr}_x\text{O}_3$ on Si and Sapphire show ferromagnetism at mole fractions of $x=0.03$ up to $x=0.5$. We examine the conditions under which negative refraction in the region of a magnon resonance near 10 THz is proposed to take place.

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