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Optical properties of ferrimagnetic $NiFe_2O_4$ thin films DIPANJAN MAZUMDAR, Center for Materials for Information Technology, University of Alabama, QI SUN, KEN O NEAL, BRIAN HOLINSWORTH, HUNTER SIMS, Chemistry Department, University of Tennessee, JIANXING MA, ARUNAVA GUPTA, WILLIAM BUTLER, JANICE MUSFELDT, Center for Materials for Information Technology, University of Alabama, U ALABAMA TEAM, U TENNESSEE TEAM — Magnetic insulators like $NiFe_2O_4$are attracting attention due to the high Curie temperature (850 K), which is rare among oxides . We recently demonstrated the growth of high-quality $NiFe_2O_4$ thin films practically down to room temperature, which permits investigation of the optical properties over wide growth temperatures. Our spectroscopic work reveals that $NiFe_2O_4$ displays both direct and indirect band gaps. A plot of $(\alpha E)^2$ vs. energy places the 300 K direct gaps for the highest quality films at 2.77 and 2.36 eV for the majority and minority channels, respectively whereas a plot of $(\alpha E)^{0.5}$ vs. energy places the indirect band gap at 1.64 eV. For the indirect case, we extract a coupling phonon energy of $\sim$50 meV (400 cm^{-1}), which corresponds an infrared active O-Fe-O bending mode. The difference between the direct and indirect gap energies reveals an opportunity to obtain spin-polarized carriers via optical excitation. These features have strong overlap with the solar spectrum.

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