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Field-Effect Tunable Epsilon-Near-Zero Perfect Absorption.[1] ALEKSEI ANOPCHENKO, LONG TAO, CATHERINE ARNDT, Department of Physics, Baylor University, HO WAI HOWARD LEE, Department of Physics, Baylor University; IQSE, Texas AM University College Station — High efficient light absorbers are in demand for light harvesting, high-resolution, and optical coating technologies. Recent studies suggest that zero-index or epsilon-near-zero (ENZ) materials can be used in making ultrathin perfect absorbers. Indium tin oxide (ITO) with electron concentration controllable over a broad range of 510^{20}-210^{21} cm^{-3} shows ENZ in the near-IR region of 700 nm -1.8 μm. The ultrathin layers of ITO support certain plasmonic modes at ENZ frequencies. Excitation of these modes leads to resonant light absorption with 100% efficiency. In this talk, we show, for the first time, post-fabrication tuning of the ENZ perfect absorption in ITO thin film. We will discuss perfect absorption in deep subwavelength ($\lambda/100$) ITO nanolayers due to the excitation of the bound and radiative ENZ modes. The nanolayer thickness required for the mode critical coupling and perfect absorption is computed for each ENZ mode and used to evaluate the optimal thickness for the perfect absorption tuning. The resonant absorption wavelength is tunable via the field-effect in a metal-oxide-semiconductor (MOS) capacitor. The direct tuning of the perfect absorption is possible due to the subwavelength thickness (<8 nm) of the ENZ perfect absorber - comparable to the Debye length (˜1 nm) of the electron accumulation region. The post-fabrication tuning of about 20% of perfect absorption with respect to the full width at half maximum of the absorption peak is achieved for the devices under study.

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