Abstract Submitted
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Gate-tunable electromagnetically-induced transparency plasmonic modulator[1] LONG TAO, ALEKSEI ANOPCHENKO, JINQIANNAN ZHANG, SUDIP GURUNG, HO WAI HOWARD LEE[2], Department of Physics, Baylor University, Waco, TX 76798, United States — Plasmonic components show promising properties in building interconnects for future photonic and electronic hybrid circuits due to their nanoscale footprints and high optical bandwidth. Along with this idea, we demonstrate an electrically tunable ultracompact plasmonic modulator. To enhance modulation strength, we use the electromagnetically-induced transparency configuration. The modulator is a metal-oxide-semiconductor (MOS) slot waveguide structure consisting of two stubs on the same side of bus waveguide forming a coupled system. Heavily n-doped indium tin oxide (ITO) is used as the semiconductor in MOS waveguide. By electrically biasing the MOS structure, we show a modulator with large modulation strength (more than 10 dB/μm), low waveguide loss (less than 1 dB/μm), and a small footprint. The large modulation strength can be explained by the formation of the epsilon-near-zero layer at the ITO-oxide interface at the wavelength of the modulated signal. Numerical simulation results reveal that such a significant modulation can be achieved with a small voltage (3 V). This result shows promise in developing nanoscale modulators for future compact photonic integrated circuits.

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