Abstract Submitted
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Composite Metal-Semiconductor Metamaterials with Negative Permittivity and No Loss A.M. BRATKOVSKY, E.V. PONIZOVSKAYA, S-Y. WANG, Hewlett-Packard Labs, Palo Alto, P. HOLMSTROM, KTH, Stockholm, L. THYLEN, KTH. Stockholm — Close to the resonance in a planar interface between a metal and dielectric, where $\varepsilon_{metal} \approx -\varepsilon_{dielectric}$, very tight electromagnetic field confinement results, but the tighter the confinement, invariably, the higher the propagation losses. For confinement significantly better than that of Si nanowires (∼300 nm) propagation losses become prohibitively high for most interconnect applications. Also, the magnitude of ε_{metal} needs to be larger than e.g. 2 in order to interface to common dielectrics for close to resonance conditions. The most straightforward way to alleviate this situation is of course to use optical gain. We have analyzed theoretically a metamaterial, which is a mix of quantum dots (QDs) half of them pumped and half absorptive and showed that one could indeed compensate the loss. More efficient way of obtaining the ε'<0 is to use metals, and we show that a combination of silver rods, supplying the negative ε and pumped QDs, providing the gain necessary to compensate the loss in the silver rods [1].

[1] A. Bratkovsky, E. Ponizovskaya, S-Y. Wang, P. Holmström, L. Thylén, Y. Fu, and H. Ågren, Appl. Phys. Lett. **93**, 193106 (2008)

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