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The Role of the Absorption in the Stop Band Tuning of Opals and Inverse Opals Through Coating of Semiconductor Materials[1] JESUS MANZANARES-MARTINEZ, DIEGO SOTO-PUEBLA, Departamento de Investigacion en Fisica (DIFUS), Universidad de Sonora — In this work we report on the modeling of the optical properties of semiconductor in-filled opals and inverse opals for the visible and near infrared spectral region. The crucial influence of the absorption is theoretically investigated by using the three dimensional Transfer Matrix Method (TMM). Fine-tuning of the stop band positioning is achieved with increasing semiconductor infiltration. The red shift of the stop band can be explained by Bragg's law. However, the optical properties depend strongly on the value of the absorption that is directly related to the imaginary part of the Dielectric Constant (DC). We use a realistic model of the DC for a specific semiconductor (InSb) that takes into account the phononic contributions, intrinsic electron and hole densities. By positioning the stop band in the region of the smaller value of the imaginary part of the DC we optimize the value of the lattice constant in order to optimize tuning of the stop band with fewer losses. We also study the influence of absorption in the Fabry-Perot oscillations and in the higher energy stop bands. This work is motivated by new experimental results that show that absorption in 3D structures can be the limiting factor to obtain a useful structure for tuning.

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