Films of SiO₂ spheres in a periodic array infiltrated with Au nanoparticles (NPs), were obtained by the co-assembly method. Samples with low (M1), medium (M2) and high (M3) concentrations of Au NPs were characterized by SEM, TEM and UV-Vis and Raman Spectroscopies. The images the microscope show that the average size is 275 nm and 22 nm for SiO₂ sphere and Au NP, respectively. Also, with the infiltration procedure the NPs form clusters and reside in the interstitial sites of the FCC array without modifying significantly the distance between the centers of the SiO₂ spheres. However, the photonic band gap is shifted to larger wavelengths compared to the bare SiO₂ Film. These samples are proposed as SERS substrates, and to evidence their sensitivity, Methylene Blue was used as the molecular probe at different concentrations. An Enhancement Factor, EF, of ~10³⁵ is reached when the M3 film is used as SERS substrate. To have an insight about the Au NPs concentration effect in the SERS EF, discrete dipole approximation was employed to calculate the near electric field intensity of a system of SiO₂ spheres and Au NPs, observing that the near field is more intense in the region between the SiO₂ sphere surface and the Au NPs close to it.

**Keywords:** Silica Films, Gold Nanoparticles, SERS

**Acknowledgment:**

This work was supported by the CONACYT-Cátedras project 3208.

**Presenting author's email:** miller.toledo@gmail.com