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Study of plasmonic crystal to metamaterial transition in dielectric doped two-dimensional periodic structures SHIVKUMAR GOURSHETTY, CHARLES REGAN, LUIS GRAVE DE PERALTA, AYRTON BERNUSSI, Nano Tech Center, Texas Tech University — We investigated experimentally the transition from plasmonic crystal to metamaterial in dielectric-loaded plasmonic two-dimensional periodic structures with different lattice periods and lattice symmetries. The transition occurs due to changes in the effective refractive index of the plasmonic crystals when the period and/or the size of the patterned features are varied. The effective refractive index of the plasmonic structure can be further modified when an object (i.e. a virus, a bead, a cell, etc.) is placed on the top of the sample, thus altering the transition. This can be prospectively used for nanosensing applications. The samples investigated here were fabricated using a combination of electron-beam lithography and liftoff techniques and consisted of a glass substrate, a thin film of gold, and periodic arrays of air holes defined on PMMA doped with Rhodamine 6G. The plasmonic crystal to a metamaterial transition region was investigated using the leakage radiation microscopy technique. We determined that the transition occurs for lattice periods 262 nm and 310 nm for samples with square and hexagonal lattice symmetries, respectively.

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