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Electronic Supplementary Information

Fabrication of Multi-material 3D Structures by the Integration of Direct Laser Writing and MEMS Stencil Patterning

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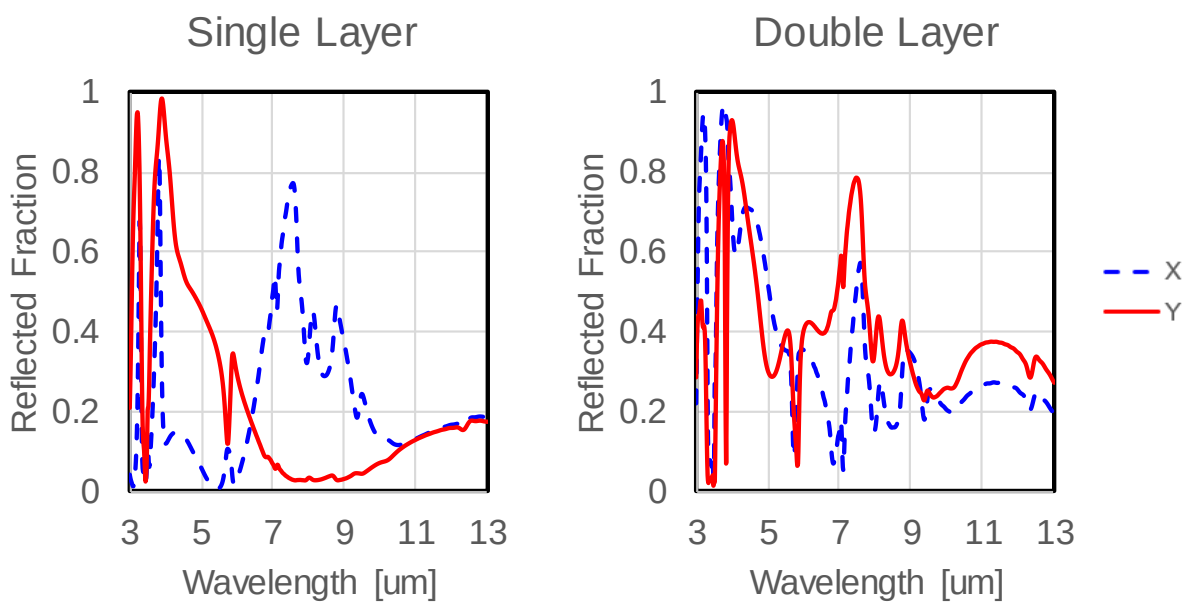

Figure S1: Finite difference time domain (FDTD) simulations of the single and multi-layer structures were performed using the Lumerical software package. SRRs with side length 1.2 um and line width 300 nm and thickness 50 nm, were simulated on a 2 micron thick IP-Dip substrate. All simulated objects are assumed to be regular rectangular prisms with no surface roughness or granularity. The IP Dip optical parameters were extracted from thin film measurements of reflection and transmission of polymerized resist. For the double layer structures, the layers were spaced by 2 um of air. The simulations show similar qualitative behavior to the experimental data. The two layer structures demonstrate evidence of both layers contributing to the reflected spectra. Narrow peaks in the single layer X spectrum around 3.5 um seem to be related to the weaker peaks in the experimental data at the same wavelengths. The reduced resonance peak heights can be contributed to increased losses in the real material due to the granularity of the evaporated metal and surface roughness of the polymer. Detailed agreement between resonance widths and strengths would require a more comprehensive model including the above effects and a more accurate representation of the SRR geometry to include rounded edges.