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Deposition of functional nanoparticle thin films by resonant infrared laser ablation. RICHARD HAGLUND, STEPHEN JOHNSON, Vanderbilt University, HEE K. PARK, AppliFlex LLC, KANNATESSEN APPAVOO, Berea College — We have deposited thin films containing functional nanoparticles, using tunable infrared light from a picosecond free-electron laser (FEL). Thin films of the green light-emitting molecule Alq_3 were first deposited by resonant infrared laser ablation at 6.68 μm, targeting the C=C ring mode of the Alq_3. TiO_2 nanoparticles 50-100 nm diameter were then suspended in a water matrix, frozen, and transferred by resonant infrared laser ablation at 2.94 μm through a shadow mask onto the Alq_3 film. Photoluminescence was substantially enhanced in the regions of the film covered by the TiO_2 nanoparticles. In a second experiment, gold nanoparticles with diameters in the range of 50-100 nm were suspended in the conducting polymer and anti-static coating material PEDOT:PSS, which was diluted by mixing with N-methyl pyrrolidinone (NMP). The gold nanoparticle concentration was 8-10% by weight. The mixture was frozen and then ablated by tuning the FEL to 3.47 μm, the C-H stretch mode of NMP. Optical spectroscopy of the thin film deposited by resonant infrared laser ablation exhibited the surface-plasmon resonance characteristic of the Au nanoparticles. These experiments illustrate the versatility of matrix-assisted resonant infrared laser ablation as a technique for depositing thin films containing functionalized nanoparticles.

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