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Resonant Infrared Matrix-Assisted Pulsed Laser Evaporation (RIR-MAPLE): An Enabling Technology for Polymeric Thin Films[1]

ADRIENNE STIFF-ROBERTS, Department of Electrical and Computer Engineering, Duke University — Resonant infrared matrix-assisted pulsed laser evaporation (RIR-MAPLE) is a promising thin film deposition technology for polymeric materials for two primary reasons: i) the ability to control and tune many aspects of nanoscale morphology, and ii) the ability to deposit multi-layered films, regardless of the constituent material solubilities. RIR-MAPLE is most successful when the incident laser wavelength is tuned to an absorption peak in the host matrix that is absent from the guest material. Therefore, a novel approach using target emulsions of a desired guest material and corresponding solvent with water has been developed that is compatible with a table-top Er:YAG laser. The fixed emission wavelength of the laser at 2.9 um is resonant with hydroxyl (O-H) bonds. This emulsion approach enables high-quality, thin-film deposition with minimal photochemical and structural degradation. The emulsion RIR-MAPLE technique has been used for the thin film deposition of a variety of conjugated polymer, small molecule, nanoparticle, and blended/bulk heterojunction material systems. Of particular interest is the application of these polymeric thin films to photonics and optoelectronics. Examples of RIR-MAPLE-deposited films to be presented include blended polymer films for optical coatings, hybrid nanocomposite films for solar cells, and light-activated biocidal films for antimicrobial applications.

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Adrienne Stiff-Roberts
Department of Electrical and Computer Engineering, Duke University

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