

Photoluminescent Graphene-Lanthanide Heterostructures via Direct Laser Writing and Area-Selective Atomic-Molecular Layer Deposition

Aleksei Emelianov¹, Kamila Mentel¹, Amr Ghazy², Andreas Johansson³, Maarit Karppinen², Mika Pettersson¹

¹Nanoscience Center, Department of Chemistry, University of Jyväskylä, FI-40014 Jyväskylä, Finland

²Department of Chemistry and Materials Science, School of Chemical Engineering, Aalto University, FI-00076 Aalto, Espoo, Finland

³Nanoscience Center, Department of Physics, University of Jyväskylä, FI-40014 Jyväskylä, Finland

emeliaa@jyu.fi

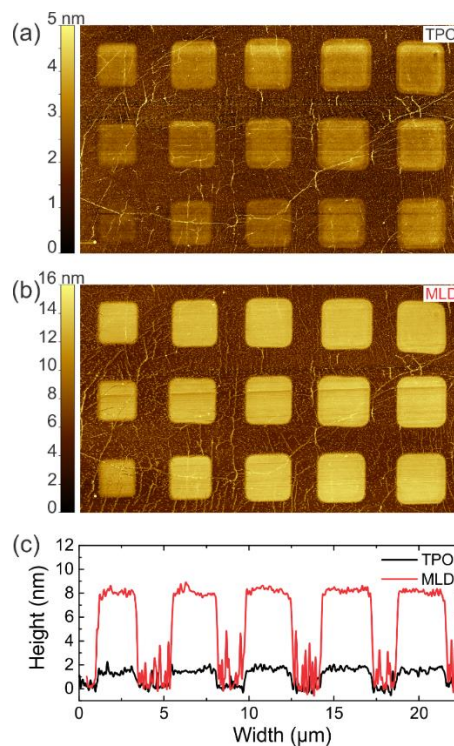


Figure 1. (a) AFM image of single-layer graphene after two-photon oxidation (TPO) with different femtosecond laser fluence. (b) AFM image of single-layer graphene after ALD/MLD of a 6 nm Eu film. (c) Height profiles after TPO and ALD/MLD measured across the second line in (a) and (b).

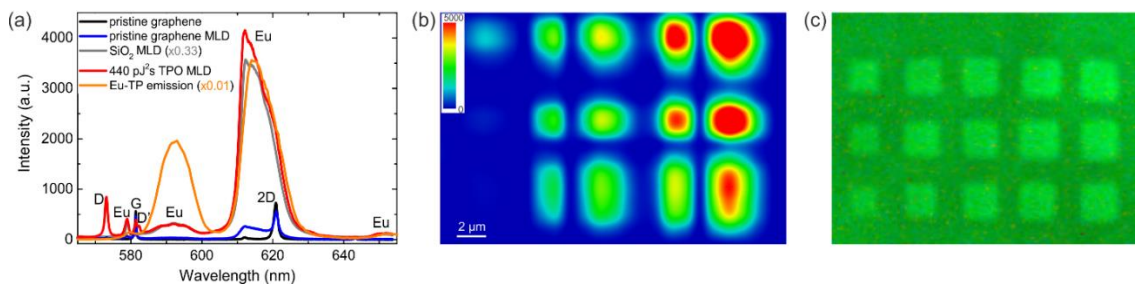


Figure 2. (a) Raman spectra before and after ALD/MLD on graphene and SiO₂, and emission spectrum of Eu-TP. (b) Raman map of a PL band of Eu-TP at 615 nm after ALD/MLD. (c) Fluorescence-lifetime imaging microscopy image of Eu film deposited on graphene and excited with a 532 nm laser.