Investigation of laser-induced effects in molecular layers by scanning tunneling microscopy

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Appl. Phys. A ***66****, 1237 (1998)*

Aiming at the detection of laser-induced currents caused by resonant optical excitation of adsorbed molecules with a scanning tunneling microscope, we have developed a method that provides access to very small laser-induced effects normally hidden in the thermal background. An optical compensation setup based on two lasers with different wavelengths for controlling very precisely the thermal signal, together with a special scheme for signal averaging and interpolation, provides access to laser-induced signals down to < 100 fA. We apply this method to molecular films consisting of islands of the dye perylene-tetracarboxylicdianhydride (PTCDA) embedded in the liquid crystal octylcyanobiphenyl (8CB). Under complete compensation of the background, a statistically significant residual laser-induced current has been observed on the PTCDA islands with a magnitude of 125 fA_{rms} at a modulated laser intensity of 3.5 kW_{rms}/cm^2.