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Modification of GaAs(1 0 0) surfaces upon adsorption of perylene derivatives

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Abstract

Molecules of 3,4,9,10-perylene-tetracarboxylic dianhydride (PTCDA) and *N*,*N*′-dimethylperylene 3,4,9,10-dicarboximide (DiMe-PTCDI) were deposited by organic molecular beam deposition onto highly doped S-passivated GaAs(1 0 0):2 × 1 substrates in ultra-high vacuum. Raman spectroscopy was performed *in situ* under resonant conditions allowing the detection of the most intense internal molecular modes in the spectral region 1200–1700 cm^{-1} even for sub-monolayer coverages. The vibrational spectra show that the first molecules arriving on the substrate interact with surface defects mainly due to dopant atoms. Their interaction strength was probed by annealing a thick film of PTCDA and DiMe-PTCDI above the desorption temperature of the organic materials. The molecules adsorbed further on the passivated surface after the saturation of defects are involved in weaker interaction, comparable to the inter-molecular one. Complementary, the relative intensities of GaAs LO and coupled plasmon–LO phonon features show that the band bending within the substrate does not change significantly upon molecular adsorption.

Author Keywords: PTCDA; DiMe-PTCDI; GaAs(1 0 0); Surface passivation; Raman spectroscopy

68.60.−p; 68.35.Dv; 78.30.Jw; 78.66.Qn; 81.15.Ef

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