Contribution ID: **326** Type: **Contributed**

# Strain relaxation and epitaxial relationship of perylene overlayer on Ag(110).

*Wednesday 20 June 2018 16:20 (20 minutes)*

We present a room temperature STM and HREEL study of perylene self-assembly on Ag(110) beyond the monolayer coverage regime.
Coupling of the perylene aromatic boards yields π-π bonded stacks. The perylene stacks self-assemble into a continuous three dimensional (3D) epitaxial overlayer of (3x5) symmetry. The self-assembly was driven by thermodynamic balance of the three factors: (i) the site recognition effect, (ii) the intermolecular interaction and (iii) the thermal motion of the perylene molecules. The balance bestows to the overlayer the unique ability to accommodate the underlying substrate morphology. The overlayer is able to spread over the surface steps as a single structure preserving its lateral order and keeping epitaxial relationship with every surface terrace. The complete epitaxy is driven by (i) anchoring of half of the perylene stacks into define adsorption sites on each terrace, (ii) interlacing of the perylene stacks across the steps within the entire H-bonded network and (iii) relaxation of the overlayer strain, stemming from the interplay of the molecule-substrate and molecule-molecule interaction, via short-range thermal motion of the molecules.
This complete epitaxy phenomenon is described via (i) structural and statistical analysis of the molecularly resolved STM topographies (ii) detection and analysis of particular vibration modes enhanced by electron-phonon coupling (iii) monitoring of the short-range molecular displacements under the strain relaxation and (iv) parametrization of the intermolecular interaction via pair potential calculation.

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**Session Classification:** Surface Science & Applied Surface Science

**Track Classification:** Nanometer Structures & Nanotechnology