X-ray Spectroscopy Study of Surface-Assisted Graphene Growth from Brominated Molecular Precursors on Silver Substrates

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Abstract The bottom-up surface-confined fabrication of graphene architectures employing 1,6-dibromo-pyrene has been tracked by a combination of X-ray spectroscopy techniques: angle-resolved photoelectron spectroscopy (ARPES), high-resolution core level photoemission (HR-XPS), near-edge absorption spectroscopy (NEXAFS) and work function measurements.
The formation of different precursor layers have been investigated on Ag(110) and Ag(111) surfaces as a function of temperature and coverage and monitoring the evolution of the system we have clearly observed a progressive rearrangement of intermolecular architectures. In particular, the correlation of temperature-dependent work function measurements with temperature-dependent core level photoemission has given important clues on the adlayer-substrate interaction and the progressive formation of intermediate species. The adlayers arise from organometallic units formed through homolytic dissociation of the C-Br bonds and carbon-Ag adatom bond evolution into structures with the spectroscopy signatures typical of graphene formed by the on-surface polymerization of debrominated molecular units. The evidence of graphene formation is given by UPS, ARPES, C 1s core level and C K edge NEXAFS. We observe that besides the temperature, the initial coverage is an important parameter for the surface-assisted growth of graphene by brominated molecular precursors on silver substrates under UHV conditions.