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Platinum Nanoparticles Strongly Bonded to Freestanding Graphene[1] PAUL THIBADO, J.K. SCHOELZ, P.K. GHOSH, J. THOMPSON, University of Arkansas, Fayetteville, L. DONG, Qingdao University of Science and Technology, M. NEEK-AMAL, F.M. PEETERS, Universiteit Antwerpen — Freestanding graphene membranes were successfully functionalized with platinum nanoparticles (Pt NPs). The membranes were imaged using high-resolution transmission electron microscopy, revealing a homogeneous distribution of uniformly sized, single-crystal Pt NPs that exhibit a preferred orientation and nearest-neighbor distance. The Pt NPs were also found to be partially elevated by the graphene substrate, as deduced from atomic-resolution scanning tunneling microscopy (STM) images. Furthermore, the electrostatic force between the STM tip and sample was utilized to estimate the binding energy of the Pt NPs to the suspended graphene. Local strain accumulation due to strong sp^3 bond formation is thought to be the origin of the Pt NP self-organization. Such detailed insight into the atomic nature of this functionalized system was only possible through the cooperation of dual microscopic techniques combined with molecular dynamics simulations. The findings are expected to shape future approaches to develop high-performance electronics based on nanoparticle-functionalized graphene as well as fuel cells using Pt NP catalysts.

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