Abstract Submitted
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Self-Organized Platinum Nanoparticles Elevated on Freestanding Graphene[1] MATTHEW ACKERMAN, PENG XU, STEVEN BARBER, JAMES SCHOELZ, DEJUN QI, PAUL THIBADO, University of Arkansas, LIFENG DONG, Missouri State University, JIANHUA YU, Qingdao University of Science and Technology, FANGFANG XU, Shanghai Institute of Ceramics, MEHDI NEEKAMAL, FRANCOIS PEETERS, Universiteit Antwerpen — Freestanding graphene membranes were successfully functionalized with platinum nanoparticles (Pt NPs) using a single-step sputtering deposition process. 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 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 NPs to the suspended graphene. Local strain accumulation due to elevation during the growth process is thought to be the origin of the 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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