Supporting Information

Metal Adsorption and Nucleation on Free-Standing Graphene by Low-Energy Electron Point Source Microscopy

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S1. Comparison between LEEPS microscopy and TEM images

In the following we show holograms of Pd clusters on graphene taken with the LEEPS microscope, as well as the hologram reconstructions that we compare to high-energy TEM images taken at the same sample area, as displayed in Figure S1. Pd clusters were grown by in situ deposition in the LEEPS microscope, as described in the main text. The TEM images have been acquired by a Philips CM100 microscope, available at the Center for Microscopy and Image Analysis of the University of Zurich, operated at an acceleration voltage of 80 kV. From the comparison between the hologram reconstructions (Figure S1c and Figure S1e) and the corresponding TEM acquisitions (Figure S1d and Figure S1f), it is possible to compare the overall shape of the clusters imaged by LEEPS microscopy and by TEM imaging. While the overall outer shape of the clusters appears similar, the TEM images rather show an arrangement of smaller clusters in contrast to a compact structure as the hologram reconstructions suggest. There are several possible reasons why the clusters in the LEEPS microscope imaged with low-energy electrons, appear compact instead of somewhat granular as later observed with 80 keV in the TEM. One should keep in mind, that the deposition and imaging of Pd has been done under UHV conditions with a properly cleaned graphene sample and a thoroughly degassed Pd evaporator; implying that really clean Pd on graphene has been imaged. For the later TEM study, the sample had to be exposed to air for at least 30 minutes or so prior to be inserted in a non-UHV

commercial TEM. Exposing graphene to air leads to significant contamination. In addition, the Pd clusters are allowed to chemically interact with various gases in the air environment during transfer, like oxygen, carbon dioxide and water vapor. Additional contamination of hydrocarbons present in the TEM, may lead to additional reaction products. Moreover, knock-out damage caused by the 80 keV electrons used of imaging are likely to cause additional changes to the morphology and chemical composition of the sample after these treatments; possibly being responsible for cluster dissociation leading to the fragments that are apparent in the TEM images displayed in Figure S1d and Figure S1f.

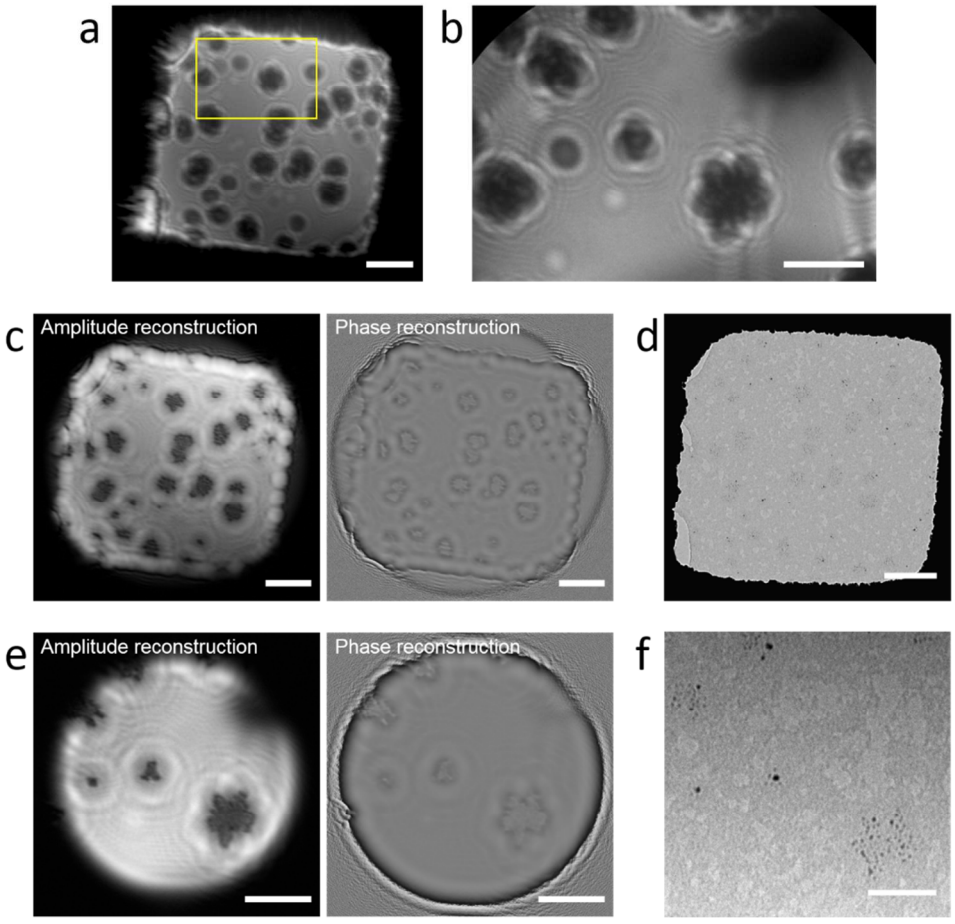

Figure S1 Low-energy electron holograms taken in the LEEPS microscope together with their reconstruction in comparison to TEM images acquired later after transfer of the sample to a commercial TEM. (a) Hologram of Pd clusters grown on freestanding single layer graphene acquired with 60 eV electrons. (b) Hologram of a magnified area indicated by the yellow rectangle in (a). The electron energy amounts to 50 eV. (c) Amplitude and phase reconstruction of the hologram shown in (a). (d) TEM image of the window shown in (a). (e) Amplitude and phase reconstruction of the hologram shown in (b). (f) TEM image of the area shown in (b). The scale bars in (a), (c), and (d) correspond to 100 nm, while in (b), (e) and (f) they correspond to 50 nm.