Gold nanoparticles on periodic self-organized iron oxide templates.

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Metal nanoparticles (NPs) are widely investigated due to their interesting properties, different from the corresponding bulk materials. For example, sub-nanometer gold clusters have an exceptional catalytic activity, especially enhanced for individual gold atoms [1]. In model studies, an important role is played by well-defined homogeneous NPs assemblies that are precisely controllable with respect to their size and density. This can be achieved using a substrate, which promotes self-assembled growth of metal NPs. The present contribution shows how this goal was accomplished using a magnetite Fe_3O_4(111) surface with so called "biphase" termination [2]. Biphase termination, in contrast to regular termination of the Fe_3O_4(111) surface, is inactive for CO adsorption [3].

Fe_3O_4(111) films with the biphase termination (Fig 1a) were grown on a Pt(111) single crystal according to the recipe described in Ref. [4]. The surface structures were confirmed by Low Energy Electron Diffraction (LEED) and Scanning Tunnelling Microscopy (STM). Room temperature deposition of submonolayer Au coverage resulted in preferential nucleation at specific sites of the biphase, resulting in formation of a hexagonal cluster network. As an example, results of deposition of 0.04 ML and 0.2 ML of Au are presented in Fig. 1b and 1c, respectively. For a given coverage gold forms NPs with a narrow size distribution. Au NPs are stable up to 500 K. Finally, their performance in CO adsorption, studied by temperature programmed desorption, was analyzed.

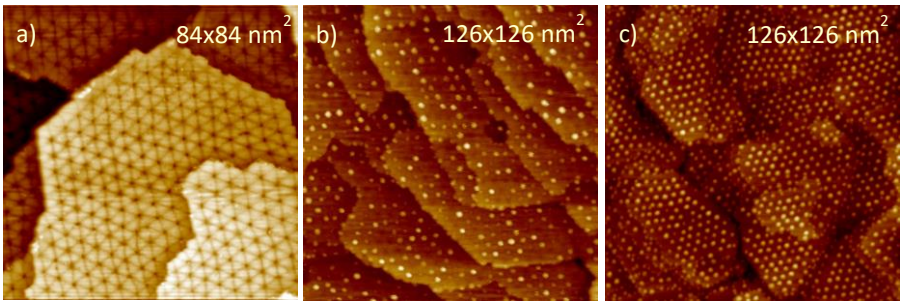

Fig. 1. STM images of the Fe_3O_4 epitaxial films on Pt(111) for a) a uniform biphase superstructure; b), c) Au NPs created by RT deposition of Au on the biphase superstructure for 0.04 ML and 0.2 ML, respectively.

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[3] J. Wojas et al., Appl. Surf. Sci., **507**, 145069 (2020)
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