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Chemical Synthesis and Electrochemical Characterization of Nanoporous Gold films

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Nanoporous gold (NPG) is conventionally made via dealloying methods¹. We present an alternative method for bottom-up chemical synthesis of nanoporous gold film (cNPGF), with properties resembling those of dealloyed NPG. The developed procedure is simple and only benign chemicals are used. Chloroauric acid is reduced to nanoparticles (NPs) by 2-(N-morpholino)ethanesulfonate, acting also as a protecting agent for the NPs and as a pH buffer, while potassium chloride is used to control ionic strength. The film formation is controlled by parameters such as temperature, ionic strength and protonation of the buffer. Therefore, it is possible to influence the trapping of nanoparticles at the air-liquid interface, yielding porous thin film structures, Figure 1A. The produced cNPGFs have been investigated by atomic force microscopy (AFM), transmission electron microscopy (TEM) and cyclic voltammetry (CV). The micro- and nanostructure of cNPGFs are shown in Figure 1B and 1C. The film coverage areas that we can achieve are up to 20 cm², with an average thickness of 500 ± 200 nm. It is also found that in-house synthesized cNPGFs are active electrocatalysts for CO₂ reduction and CO oxidation.

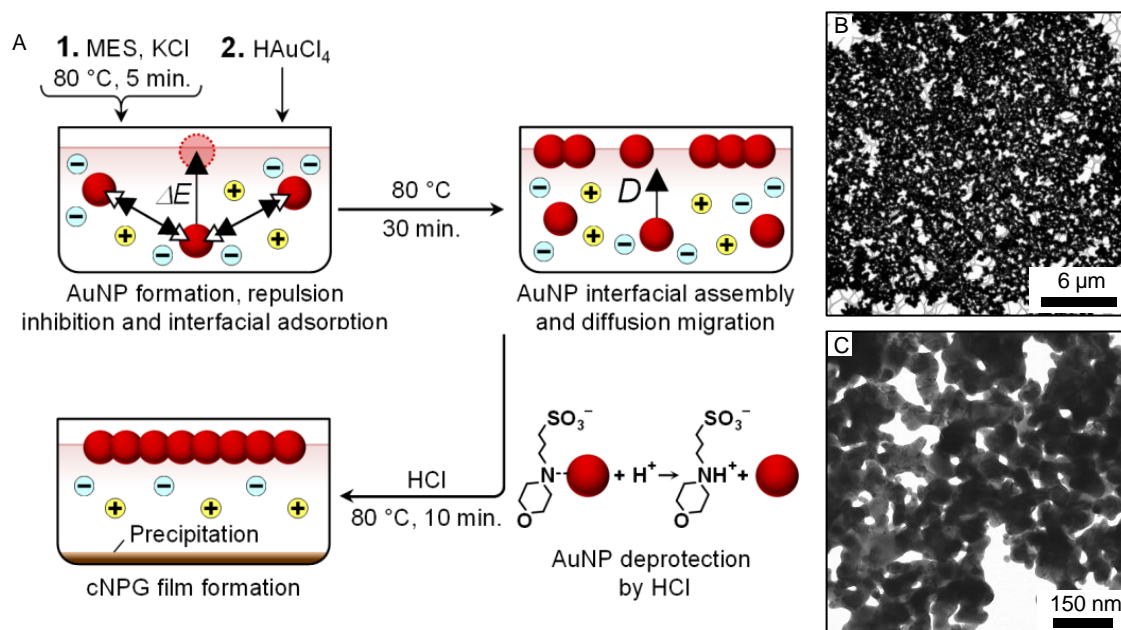


Figure 1. A) Schematic representation of cNPG film synthesis. B) TEM representation of cNPG. C) High resolution (HR-TEM) image of nanoporous structure of cNPGF.

- 1 A. Wittstock, J. Biener, J. Erlebacher and M. Baumer, Eds., *Nanoporous Gold*, The Royal Society of Chemistry, 2012.