

## *Supplementary Materials for the Article*

### **Nanoporous Au behavior in methyl orange solutions**

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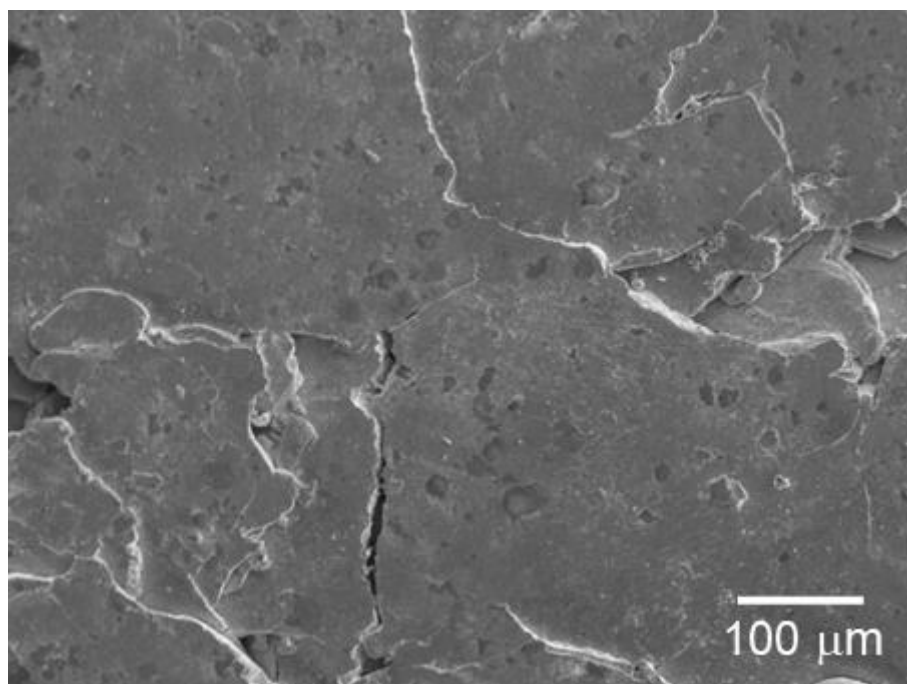
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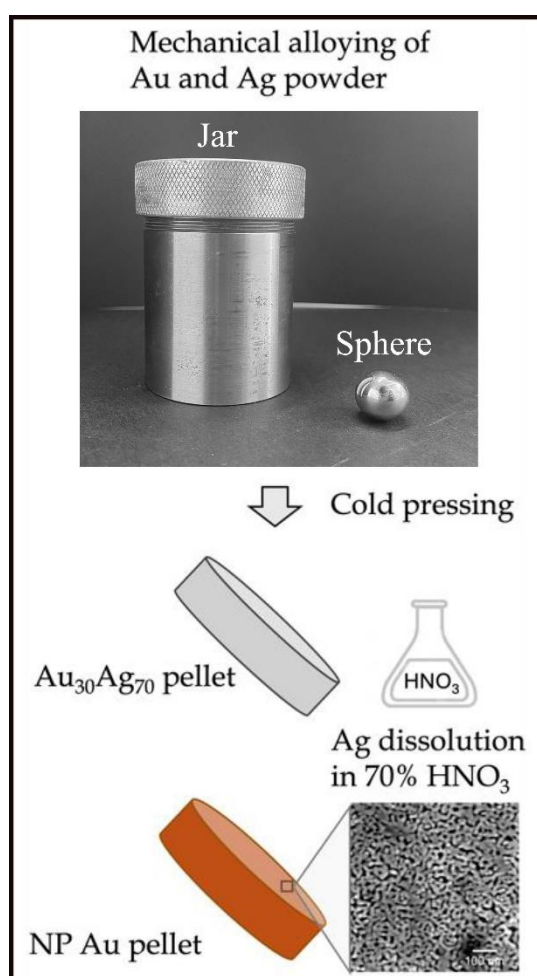
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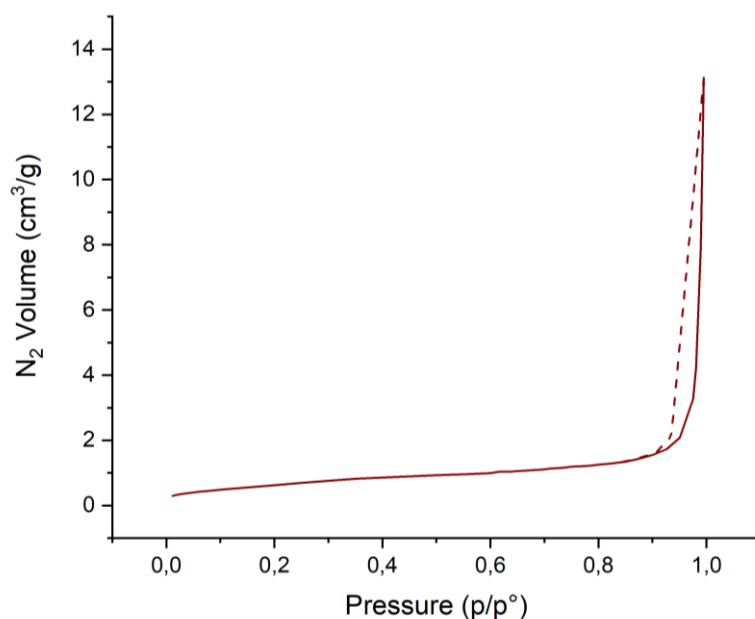
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**Figure S1.** SEM image of the pellet before the chemical corrosion in  $\text{HNO}_3$  70% for 24 h.

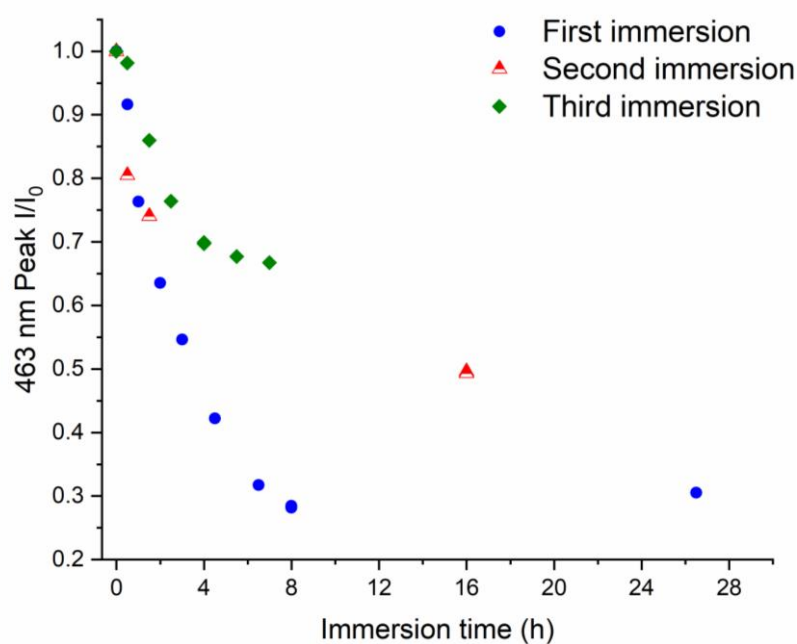


**Figure S2.** Schematic representation of the nanoporous gold fabrication process.

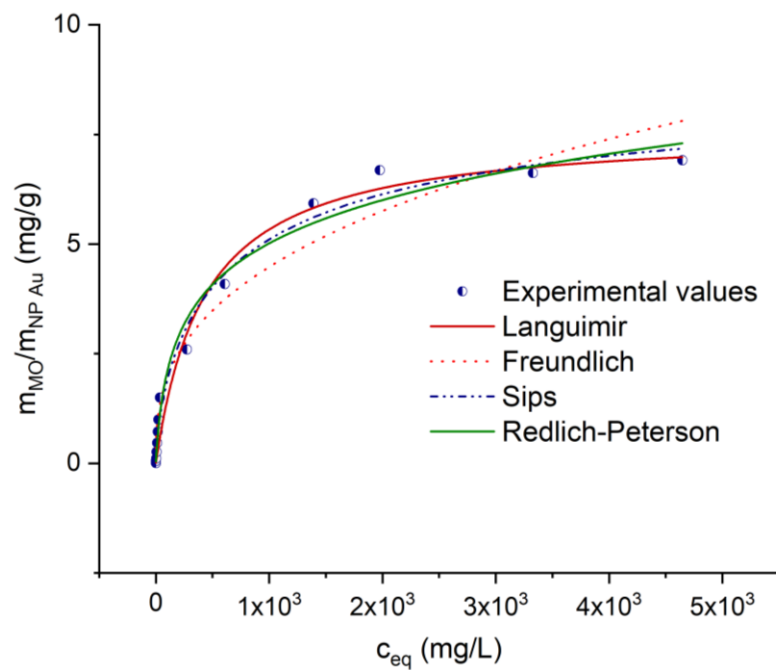


**Figure S3.** N<sub>2</sub> gas adsorption-desorption isotherm for the nanoporous gold pellet.

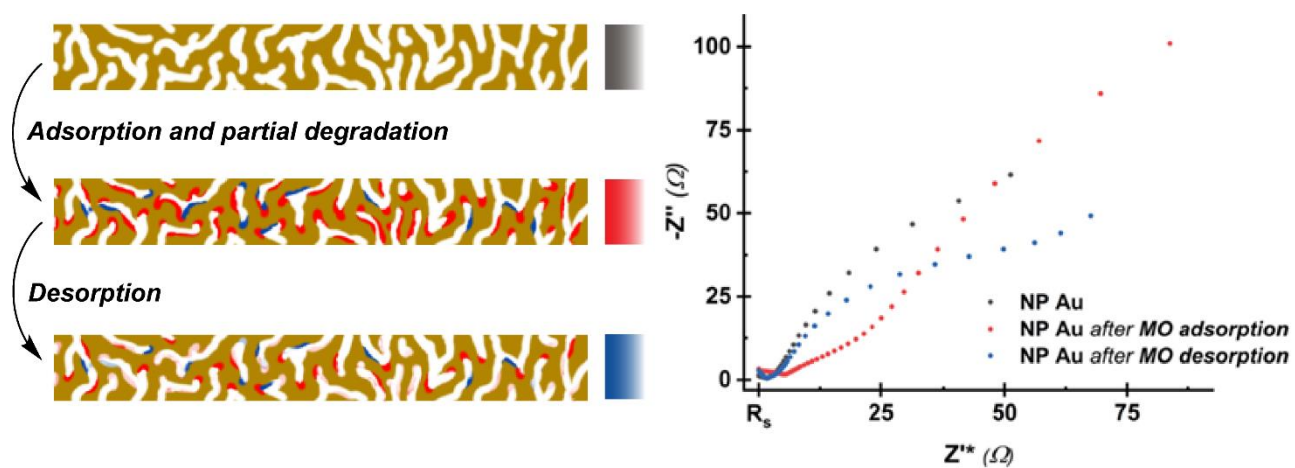
Textural analysis of an NP Au pellet was carried out with an ASAP 2020 system (Micromeritics), by determining the nitrogen adsorption-desorption isotherms at  $-196\text{ }^{\circ}\text{C}$ . Before analysis, the sample was heated overnight under vacuum up to  $200\text{ }^{\circ}\text{C}$  (heating rate,  $1\text{ }^{\circ}\text{C}/\text{min}$ ). Surface area was calculated by the Brunauer-Emmett-Teller (BET) equation. The BET analysis based on the measurement reported in Figure S3 gave a value of surface area of roughly  $2.5\text{ m}^2/\text{g}$ . According to the paper by Wittstock *et al.* [1], in the case of NP Au, this approach could lead to an underestimation of the real surface area of the pristine NP.



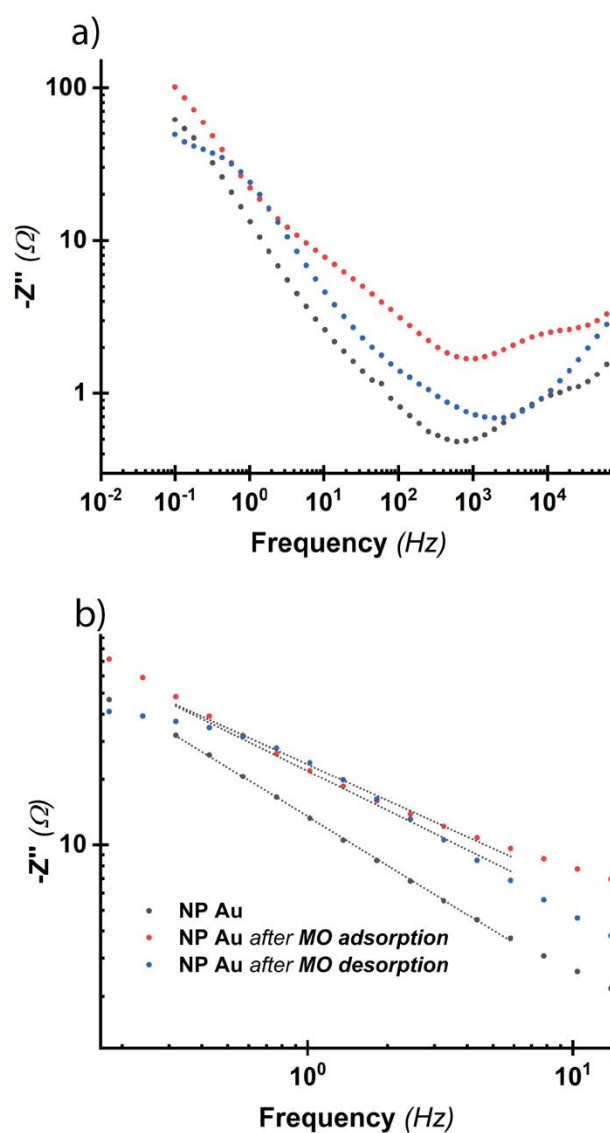
**Figure S4.** Relative concentration of MO over time for the same sample repeatedly immersed in fresh MO solution.



**Figure S5.** Comparison between several adsorption models. The best fitting is given by the Langmuir one.



**Scheme S1.** Schematic illustration of adsorption and desorption process (left), and related Electrochemical Impedance Spectroscopy measurements (right).



**Figure S6.** (a) Log-log dependance of the imaginary part of the impedance vs. frequency. (b) Magnitude and fit of the linear part in the medium-to-low frequencies.

#### Reference

1. Wittstock, G.; Bäumer, M.; Dononelli, W.; Klüner, T.; Lühns, L.; Mahr, C.; Moskaleva, L.V.; Oezaslan, M.; Risse, T.; Rosenauer, A.; et al. Nanoporous Gold: From Structure Evolution to Functional Properties in Catalysis and Electrochemistry. *Chem. Rev.* **2023**, *123*, 6716–6792. <https://doi.org/10.1021/acs.chemrev.2c00751>.