

Quantitative characterization of shear force regulation for scanning electrochemical microscopy

Supporting Information

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SI 1. Resonance frequency spectra of probe vibration

To determine the detected frequency of a probe oscillation, the mechanical resonance frequency was recorded with the shear force regulation software of the of a DS4L controller with SXM software version 0.19f (Anfatec Instruments AG, Oelsnitz, Germany). The probe was held at at different position from the surface. Figure SI-1 shows an example of the spectra where amplitude changes indicated by arrows are seen. Note that for a given probe electrode more than one detected frequencies could be realized but the selection of the suitable frequency was made based on its sensitivity in surface tracking while topography scan. The most sensitive frequencies are characterized by minimum noise signal in topographic line scan.

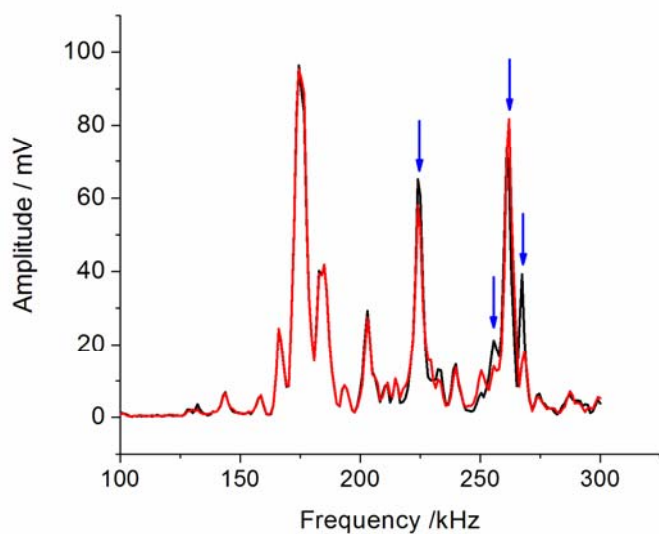


Figure SI-1. Resonance frequency spectra of the non-optical shear force detection output acquired for the nanoelectrode in solution 50 μm away from surface (black line) and closest to the surface (red curve). The arrows are suitable frequencies.

SI 2. Atomic force microscopy (AFM) height mode image of gold micro band on glass substrate

AFM images were obtained in tapping mode on a Nanoscope IIIa instrument (Veeco Instruments Inc., Plainview, NY, USA). An AFM image of a $100\ \mu\text{m} \times 100\ \mu\text{m}$ area of gold microband on glass substrate is shown in Figure SI-2. The width of the gold band $50\ \mu\text{m}$ and the height is $48\ \text{nm}$. A small scratches on the gold band is visualized which also appeared in shear force SECM image as shown in Figure 7 in manuscript.

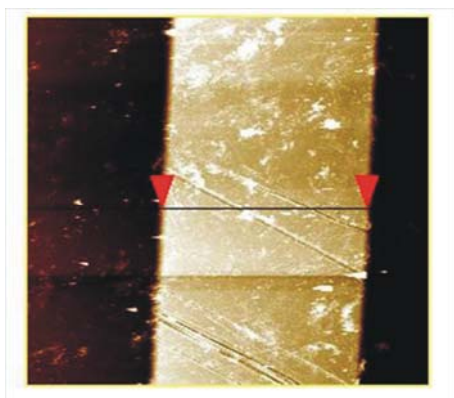


Figure SI-2. AFM topography image of gold micro band on glass substrate. Width $50\ \mu\text{m}$ and height $180\ \text{nm}$ in a good agreement with shear force topography image.