On the molecular recognition of tailored nanostructured materials.

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Abstract: The fabrication of promising metal oxides for generating efficient non-enzymatic electrochemical sensors is still a challenge, in which the progress in this field has taken place by an observation-driven and trial and error approach. In this context, although a transition to a design-driven methodology to produce materials with desired features for electrochemical or optical sensors have been reported, systematic investigations on how the several parameters that affect their performances (size, shape, composition, among others) are still scarce. New insights regarding how the exposed facets at the surface of Cu_2O crystals may affect their electrochemical sensing activities and stabilities. By a combination of theoretical and experimental design, we unraveled the effect of {111} and {100} surface facets over the metal oxides-based electrocatalytic sensing activities and stabilities employing Cu_2O crystals as a model substrate and glucose as the analyte. The mechanism of analytes oxidation was also explored by in situ techniques and a shape dependent behavior was stablished.
On the other hand, SERS platforms were prepared by combining electrochemical methods with special resolution for reliable, cheap and sensitive sensors. Among common methods for SERS substrates preparation, those with greater reproducibility usually relies on lithography, etching and ion-beam, leading to good control on surface morphology but at the expense of high-priced equipment and often extensive multi-step procedures.
Here, we present a 90-second two-step procedure focusing in the spatial delimitation of electrode's submicrometric domains by breath-figure method (BFM) with poly(methyl methacrylate) (PMMA) spin-coating, forming a thin porous film onto the ITO electrode,
The quickly-produced SERS substrates were active showing good reproducibility in both 633 nm and 785 nm excitation sources, with average enhancement factor in the order of 10^7, detection limit in the nanomolar range and stability for at least 30 days

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