Electrochemical Microscopy as a playground for the analysis and modification of electronic transport properties of 2D materials

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Electrochemical Microscopy as a playground for the analysis and modification of electronic transport properties of 2D materials

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2D materials such as graphene, graphene oxide (GO) or CVD-Molybdenum Sulfide (MoS_2) are attracting increasing attention from the scientific community.[1,2] These materials have very diverse properties, so that many potential applications in the fields of electronics, sensors, catalysis and energy storage are now envisioned.
In this field, we introduced SECM to evaluate at a local scale the electrons transport of 2D materials.[3-5] We show how images of individual and interconnected flakes directly reveal the signature of intrinsic and contact resistance between flakes in a non-contact and substrate-independent way. Complex electronic conductivity such as that obtained with CVD MoS2 can also be investigated in a straightforward fashion. Quantitative evaluation of the parameters can be achieved with the support of numerical simulations to interpret the experimental results.
Within a SECM configuration, it is also possible to functionalize locally the nano-objects. GO deposited on a silicon oxide can for example be reduced at the local scale. This locally enhances the electronic conductivity and enables the selective electrochemical functionalization of patterns.

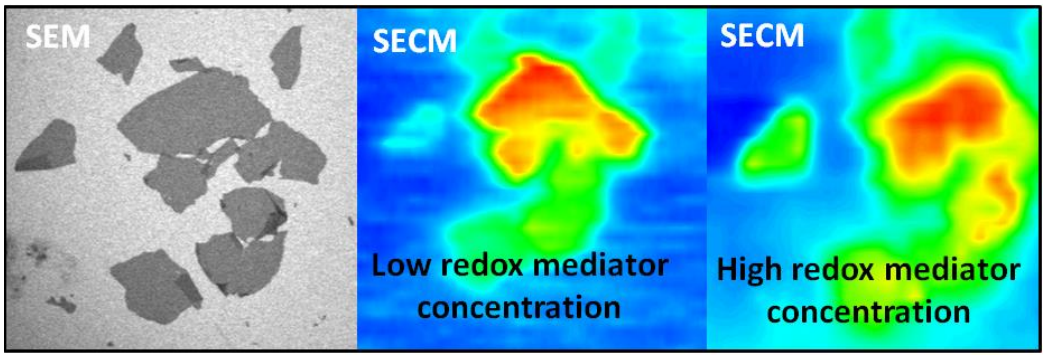

Fig. 1: Presentation of the combined SEM-SECM responses at the basis of an advanced electronic transport characterization. Taken from 3

Overall, these works illustrate the high potential and versatility of SECM to investigate and functionalize 2D materials.

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