Coupling electrochemistry with Backside Absorbing Layer Microscopy (BALM) for in-situ imaging surface reactions

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Backside Absorbing Layer Microscopy (BALM) is a new optical microscopy technique, which uses absorbing anti-reflection layers to achieve extreme contrast at an interface. It combines the vertical *sub*-nm sensitivity of an AFM with the versatility and real-time imaging capabilities of an optical microscope. Recently, we showed how this technique allows observing 2D materials and their chemical modification with unprecedented resolution (1). As an example, Fig. 1 displays single-layer graphene oxide flakes observed with BALM. It notably allows to directly identifying stacks, folds, wrinkles and defects.

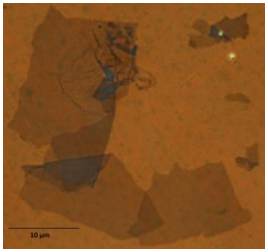

Fig.1. BALM image of single-layer Graphene Oxide flakes

The BALM geometry and its capability to image surfaces and nanomaterials in liquid are ideally suited to its coupling with electrochemistry. As a simple example, Fig. 2 presents the *in situ* monitoring of the electrodeposition of copper on gold by chronoamperometry (1). In this communication, we will specifically focus on such coupling and demonstrate its potential to address different class of problems related to electro-catalysis, electro-grafting, etc.

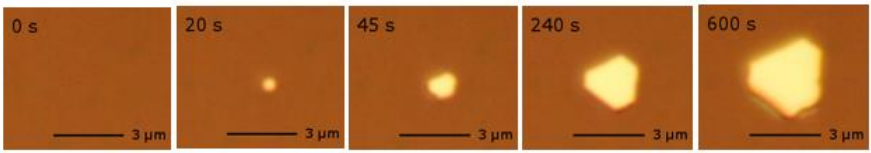

Fig. 2. Short part of a BALM movie showing the in-situ electrodeposition of copper on gold under chronoamperometry (at -140 mV vs Ag/AgCl). Extracted from (1).

(1) Campidelli, S.; Abou Khachfe, R.; Jaouen, K.; Monteiller, J.; Amra, C.; Zerrad, M.; Cornut, R.; Derycke, V.; Ausserré, D. "Backside Absorbing Layer Microscopy: Watching Graphene Chemistry", *Science Advances* **2017**, *Accepted*.