DNA origami-gold nanoparticle-graphene double hybrid structures for surface-enhanced Raman scattering

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Very recently, we have demonstrated that single-layer graphene (SLG) precisely replicates the shape of underlying triangular DNA origami structures (Fig. 1a) and at the same time effectively enhances their structural stability. [1]
Taking one step further, previously studied 40 nm gold nanoparticle (AuNP) dimers coated with TAMRA-modified DNA that are attached to DNA origami templates [2, 3] have been successfully encapsulated by SLG via mechanical exfoliation. The resulting double-hybrid structures are investigated by correlated AFM and SERS imaging to associate specific signals with defined structures (Fig. 1b,c). It is found that SERS signals originating from double-hybrid structures exhibit higher reproducibility and suppressed photobleaching in comparison to non-covered DNA origami-AuNP hybrids.

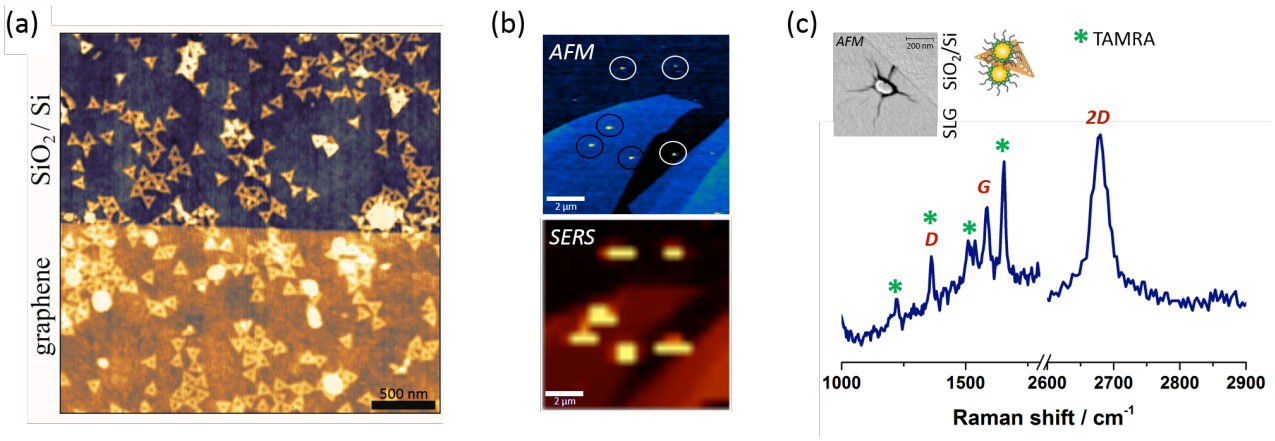

Fig. 1: (a) AFM image of triangular DNA origami substrates without (above) and with (below) SLG encapsulation. [1] (b) Correlated AFM and SERS imaging of hybrid structures covered by SLG (black circles) and without coverage (white circles). (c) SERS spectrum of one individual double-hybrid structure. Bands arising from the Raman reporter molecule TAMRA are marked with a green star; D, G and 2D bands are due to SLG.

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