# Graphene-coated Atomic Force Microscope tips with reliable nanoscale electrical characterization

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The interfacial effects between graphene and other materials have been found to impoverish its genuine properties and, between them, uncontrollable rough morphology formation is one of the most harmful in terms of homogeneity and variability. In this work we present a Scanning Tunneling Microscope and Atomic Force Microscope investigation about morphology of graphene depending on the substrate. In particular, our results show that the shape, density and size of wrinkles in graphene can be tuned using substrates with different topographic roughness. Following this procedure, we have been able to fabricate the first non suspended free-of-wrinkles sheet of graphene.

Electrical characterization at the nanoscale is an essential procedure for analyzing the performance of many materials used at both industry and academia. In this field, one of the most powerful tools is the Conductive Atomic Force Microscope (CAFM), which can characterize the electrical properties of both conductive and thin insulating materials at very small areas. The main challenge associated with this technique is the poor reliability of the tips, which metallic varnish can wear out very fast due to high current densities and frictions when scanning the surface of the sample under test. Therefore, finding a new method to avoid fast tip wearing is essential for cheap and reliable nanoscale electrical characterization. In this work, the properties of commercially available CAFM tips are modified by coating them with CVD-grown graphene. The resulting graphene-coated tip proved to be extremely stable and resistant in terms of mechanical durance and electrical characterization, such as high frictions and elevated current densities, respectively. The tips can also inhibit the sample interaction with the conductive tip coating, which is a source for false imaging.