[1011] Scanning Thermal Microscopy on 2D Materials at cryogenic temperatures

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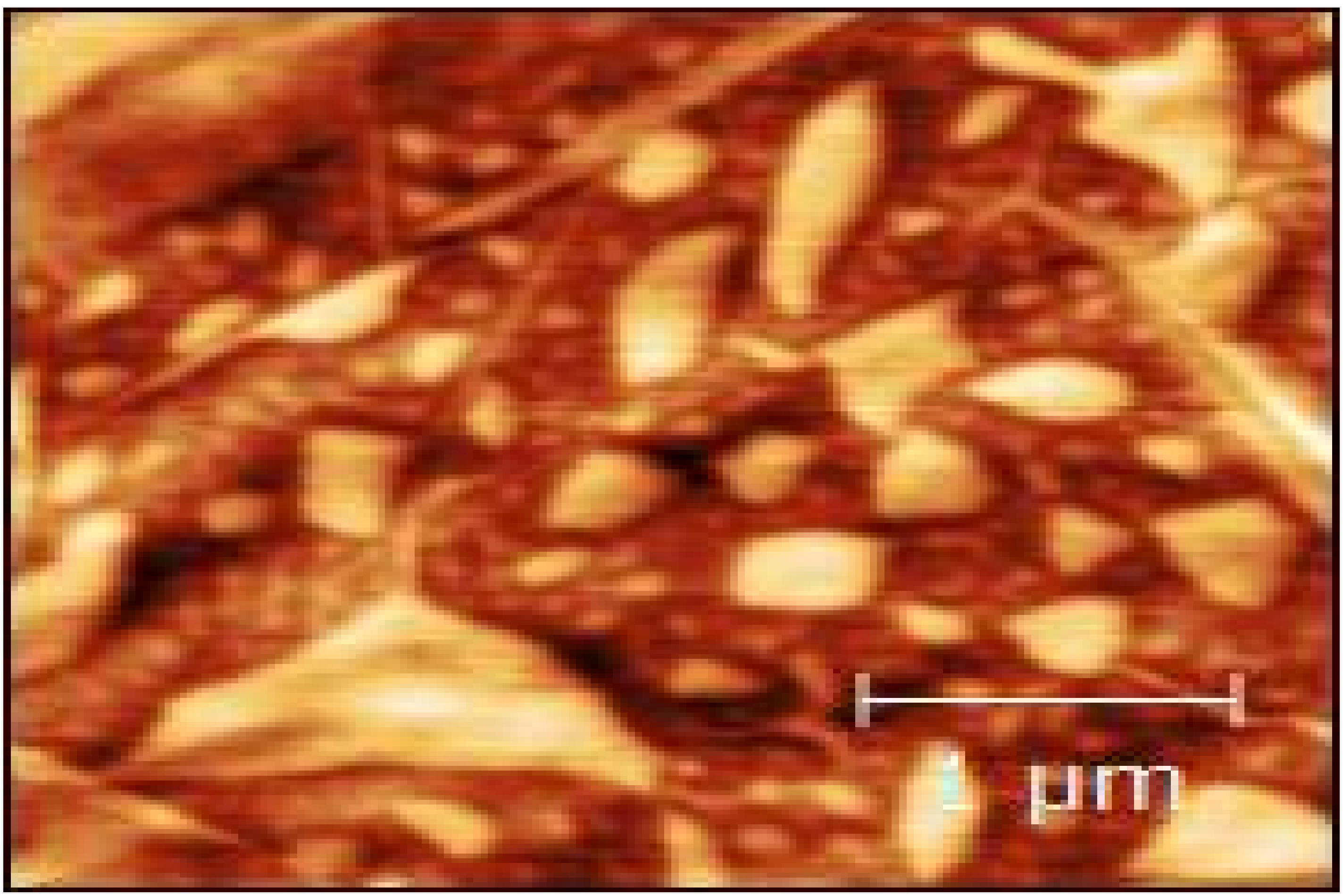
Thermal transport in Graphene is of great interest due to its high thermal conductivity, for both fundamental research and future applications such as heat dissipation in electronic devices. Although, the thermal conductivity of graphene can reduce depending on the coupling to the substrate [1]. In this work, we report high-resolution imaging of nanoscale thermal transport in single and few layers of Graphene on Silicon Oxide (SiO2) and hexagonal Boron Nitride (hBN), by Scanning Thermal Microscopy (SThM) in high vacuum. SThM is a leading technique for mapping thermal properties with nanoscale resolution [2], consisting of a self-heated probe which acts as a thermosensor during sample scanning. By using doped Si probes and cooling the sample down to 150K, we mapped the thermal resistance of Graphene layers on SiO2 and hBN with sub-10nm resolution. We observed that thermal transport in these layers changes at the elastically deformed areas, which were formed during deposition in the form of bubbles [3]. More specifically, the thermal conductance at the center of the bubbles increases with their surface area. In addition, we study the effect of the sample temperature and the substrate on the thermal conductance of the graphene layers.



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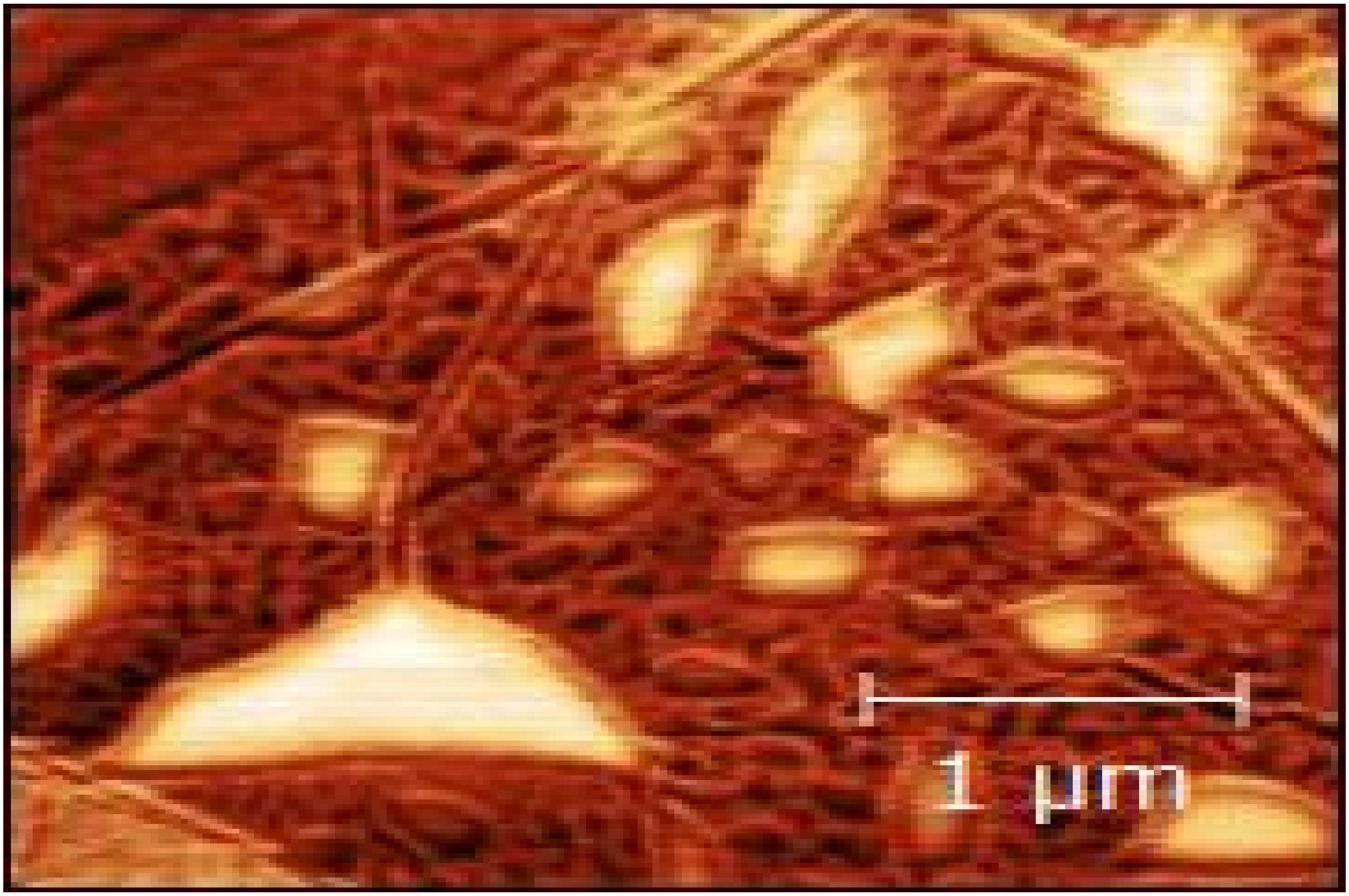

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Figure 1. AFM topography (left) and SThM probe Thermal Response (right) of few graphene layers on SiO2, acquired simultaneously.