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Graphene: Growth Peculiarities on Liquid Substrate and Some Unique Applications

Growth of high quality and large area graphene or control of its surface topography still remain challenging. The origin of surface ripples of graphene could be associated with the problem of thermodynamic stability of two dimensional membranes, presence of grain boundaries on the substrate, and the difference between the thermal expansion coefficients of graphene and a substrate. Recently the exploitation of graphene growth on liquified substrate became one of the promising trends to address this challenge. However, we have observed peculiar topographic patterns on graphene surface. In-situ SEM studies on liquified Cu substrate suggest that these patterns originate from the dynamic instabilities caused by solutocapillary forces followed by non equilibrium solidification. These non-equilibrium processes can be well understood based on Mullins-Sekerka and Benard-Marangoni instabilities in diluted binary alloys. The model offers the control parameters over the grown graphene quality. Some unique applications of graphene will be presented too.