Abstract Submitted
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Viscous peeling of a graphene sheet[1] ADYANT AGRAWAL, SIMON GRAVELLE, CATHERINE KAMAL, School of Engineering and Materials Science, Queen Mary University of London, LORENZO BOTTO, Process and Energy Department, Delft University of Technology — To get insights into the process of liquid-phase exfoliation of graphite into graphene, we study numerically the dynamics of propagation of a peeling front in a system composed of two adhered elastic sheets immersed in a liquid. The crack propagation is induced by lifting one of the edges with an assigned velocity v. A continuum model based on the lubrication theory is compared to non-equilibrium molecular dynamics (MD) simulations of a graphene-water system. We quantify the external peeling force by separating it into viscous and adhesive contributions. The continuum model predicts that for a sheet of length 100nm and a solvent of viscosity 10^{-3} Pa.s, the viscous contribution to the force is important after a threshold of pulling velocity v>10m/s, a velocity relevant to MD simulations. We explore the effect of the fluid viscosity and slip length on this threshold and discuss several limitations of the continuum model. For example, while MD agrees with the continuum model at low peeling velocities, at higher velocities the viscous-dependent contribution to the pulling force predicted by MD is much higher than the one predicted by the continuum model. We will discuss possible causes for this discrepancy.

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