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Effect of detaching force on water retention on a surface[1] NEDA OJAGHLOU, DUSAN BRATKO, HOOMAN V. TAFRESHI, ALENKA LUZAR, Virginia Commonwealth University — The interaction of droplets with a surface is crucial in engineering applications such as coating, air filtration, and liquid transport in microfluidic devices. Despite recent advances in fluid mechanics and surface science, the mechanism of droplet detachment from the surface and the amount of residue left behind are not formulated well. When the droplets are forcibly removed from a surface, the ease of detachment strongly depends on the droplet volume and the rate of the removal. Experiments and continuum level calculations have so far been unable to resolve the time-dependent dynamics of droplet detachment and the role of the applied force as the key determinant of the volume of the droplet residue on the surface. We present a comprehensive study for predicting the force required to detach the water droplet from a graphene surface through the Molecular Dynamics (MD) simulations. Our results show that the minimum detaching force (per unit mass) decreases with the volume of the droplet and increases with the strength of water-surface adhesion. We also determined the amount of residue on the surface after detachment for different forces and water-carbon interactions. We observed that as the droplet size increases, a bigger residue remains on the surface. We found that the maximum amount of residue can be observed by applying the minimum force of detachment in contrast to experimental and MD results for droplet detachment from the curved surfaces where intermediate force was found to maximize the water retention.

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