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Adhesion forces measured between colloids and nanoscale surface roughness in aqueous solution

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The importance of nanoscale roughness factors on the fate and transport of colloidal particles has been well emphasized in recent literature; however, most of the works either only used modeling tools or had limitations on unravelling the effect experimentally due to the lack of well-defined systems to solely capture the role of the nanoscale roughness. Therefore, this study aimed to "experimentally" observe the adhesion characteristics of environmental colloidal particles on a surface with nanoscale roughness (NR) factors (i.e., height and fraction) under environmentally relevant solution chemistry conditions. Prior to analyzing the effect of the NR, the solid surface was first fabricated. AFM was employed to confirm the adhesion force between the target material and the uniformly fabricated rough surface, which can influence the contact area. To the best of our knowledge, our study is the first to experimentally quantify the sole effect of the NR with well-controlled NR-surfaces via the adhesion force measurement in aqueous system. The findings are important to verify the role of NR in the interaction of particles with different shapes (i.e., sphere and plateau) and sizes (i.e., 2 μm to 15 μm in length or diameter), which the authors believe will provide new insights to the society on better understanding the role of NR in the interaction of environmental colloidal particles.

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