

A New Approach for Measuring the Contact Angle of Nanoparticles at Liquid Interfaces

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We have developed a novel generic method for determining of the three-phase contact angle of nanoparticles adsorbed at liquid surfaces. The method includes nano-imprinting of the particle monolayer at the liquid surface with polydimethylsiloxane (PDMS) based on the Gel Trapping Technique (GTT) followed by Atomic Force Microscopy (AFM) imaging of the produced PDMS replicas. The method works for nanoparticles at both air-water and oil-water interfaces and is based on spreading of a sample of nanoparticles at the liquid interface followed by gelling of the aqueous sub-phase with a non-adsorbing polysaccharide. The top phase is replaced by curable PDMS which after its polymerization is peeled off the gel and scanned with AFM. The average contact angle is estimated from the average height of particle protrusion from the PDMS surface and the average radius of same nanoparticles sample measured by AFM in a separate experiment. The novel nano-GTT (GTT+AFM) method allows a significant reduction of the lower particle size limit compared to the SEM imaging used in the original method. We have applied this method to latex nanoparticles, ranging from 37 nm in radius to 120 nm in radius, adsorbed at the air-water and n-decane-water interface. The method is expected to find application as a routine technique for measuring the contact angle of nanoparticles samples adsorbed at a range of liquid surfaces, relevant to a number of food, cosmetic and pharmaceutical formulations.