

Understanding the structure of the interface between SiO₂ nanoparticles and organic ligands

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The use of engineered metal (oxide) nanoparticles in a variety of applications and products is rapidly increasing. Among engineered nanoparticles, silica nanoparticles (often referred to as colloidal silica) is by far the most common industrial product, with extensive use in drug production, paper making, paints and sealants etc. Silica nanoparticles are generally considered to be non-toxic, but details of their interaction with environmental organic material are scarce, especially considering the multitude of available surface modifications.

Interaction between nanoparticles released into the environment and natural organic material will result in formation of a primary corona, which will change the physical and biological characteristics of the nanoparticles and affect their fate. However, the structure and dynamics of this corona are not well understood, as a molecular level description of the interfacial reactions is lacking. We aim to improve the situation by studying the interaction between engineered silica nanoparticles of varying types and sizes, and a number of organic molecules, using a combination of classic wet chemical methods, microscopy and spectroscopy.

The structure of the corona is affected by the nature of the organics involved and by the size and charge of the nanoparticles. Presented below are surface charging curves for SiO₂ nanoparticles, in the absence (solid symbols) and presence (open symbols) of the organic ligand 2,3-dihydroxybenzoic acid (2,3-DHBA). The presence of the ligand significantly affects the surface charge at environmentally relevant pH values.

