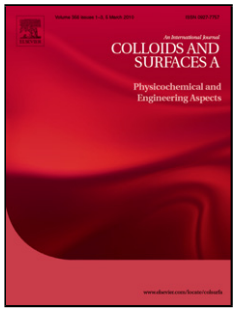

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Influence of hydrophobic nanosilica and hydrophobic medium on water bound in hydrophilic components of complex systems

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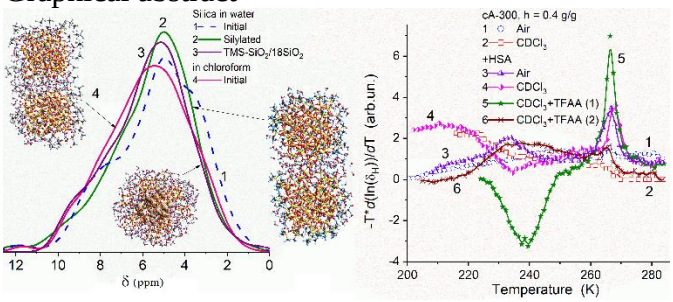
Graphical abstract



Influence of hydrophobic nanosilica and hydrophobic medium on water bound in hydrophilic components of complex systems

Highlights:

- Mechanical treatment of compacted A-300 and hydrophobic AM1 gives a nanostructured composite
- Confined space effects change the interfacial behavior of water bound in composites
- Dispersion media affect the temperature behavior of acidic solution bound in composites

Abstract

The temperature behavior of water bound to compacted nanosilica cA-300 alone or in mixture with hydrophobic nanosilica AM1 alone or with addition of human serum albumin (HSA) or tannin was compared for different dispersion media (air, $CDCl_3$ alone or with addition of HCl or trifluoroacetic acid, TFAA) using low-temperature ^{1}H NMR spectroscopy and cryoporometry. There is overlapping of the confined space effects for water bound in voids between silica nanoparticles with the effects caused by the colligative properties of aqueous solutions of TFAA or HCl. These phenomena determine the temperature behavior of bound water unfrozen at $T < 273$ K upon changes of the dispersion media. Typically, the contact area between unfrozen water and a surface of nanosilicas is smaller than the specific surface area of the solids due incomplete filling of voids between nanoparticles by bound water. Bound water tends to be in a clustered state upon the adsorption. In composites with cA-300/AM1, there is a tendency of diminution of the contact area