Effect of adsorption of fluorinated surfactant on the wetting property of CaCO₃ nanoparticles

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Calcium carbonate (CaCO₃) nanoparticles have been frequently used as one of the major ingredients in plastics, rubber, paint, adhesive, sealant, pigments, coating, toothpaste, cosmetics, thermosetting resins, paper, food, and so on. However, one of the most problematic issues for the use of CaCO₃ is the hydrophilic property, and this problem makes CaCO₃ nanoparticles very difficult to be used widely. In this study, the effect of adsorption behavior of fluorinated surfactant Zonyl® TBS (Dupont) on the wetting property of CaCO₃ substrate was investigated. A quartz crystal microbalance with dissipation monitoring (QCM-D) was used to investigate the structure and properties of the organic layer formed on CaCO₃ surface upon coating with surfactant molecules and to understand the adsorption process and properties of the adsorbed layer on a molecular level. Contact angle measurement, surface energy analysis, and floating test have been also conducted to study the effect of surfactant adsorption on the wetting property of CaCO₃ substrate. In a low surfactant concentration region, the CaCO₃ surface becomes more hydrophobic with an increase in surfactant concentration due to monolayer adsorption of surfactant molecules on the solid surface. However, further increase in surfactant concentration after the formation of a monolayer saturated with surfactant molecules produced a reverse change from hydrophobic to hydrophilic due to bilayer formation of surfactant molecules on the CaCO₃ surface. In order to confirm surface modification of CaCO₃ nanoparticles by fluorinated surfactants, Fourier infrared spectroscopy was used with a KBr pellet technique in the range from 4000 to 650 cm⁻¹. Atomic concentration of CaCO₃ particle surface treated by fluorinated surfactant has been identified by using X-ray fluorescence (XRF) spectrometer and X-ray photoelectron spectroscopy (XPS) analysis.

Literature:

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