

Organization of mixed dimethyldioctadecylammonium and choline modifiers on the surface of synthetic hectorite

Abstract

Understanding the nature of mixed surfactant self-assembly on the surface of organoclays is an important step toward optimizing their performance in polymer nanocomposites and for other potential applications, where selective surface interactions are crucial. In segmented thermoplastic polyurethane nanocomposite systems, dual-modified organoclays have shown significantly better performance compared to their single-modified counterparts. Until now, we had not fully characterized the physical chemistry of these dual-modified layered silicates, but had hypothesized that the enhanced composite performance arises due to some degree of nanoscale phase separation on the nanofiller surface, which enables enhanced compatibilization and more specific and inclusive interactions with the nanoscale hard and soft domains in these thermoplastic elastomers. This work examines the organization of quaternary alkyl ammonium compounds on the surface of Lucentite SWN using X-ray diffraction (XRD), thermogravimetric analysis (TGA), attenuated total reflectance Fourier-transfer infrared (ATR FT-IR), ¹³C cross-polarization (CP)/magic angle spinning (MAS) nuclear magnetic resonance (NMR), and small-angle neutron scattering (SANS). When used in combination with choline, dimethyldioctadecylammonium (DMDO) was observed to self-assemble into discontinuous hydrophobic domains. The inner part of these hydrophobic domains was essentially unaffected by the choline (CC); however, surfactant intermixing was observed either at the periphery or throughout the choline-rich phase surrounding those domains.

Keywords

Conformation; Dual-modified organoclay; Mixed surfactants; Polyurethane nanocomposites