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Spectroscopic studies of the effects of mechanochemical synthesis on $BaTiO_3$ nanocolloids prepared using high-energy ball-milling

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ABSTRACT

$BaTiO_3$ ferroelectric nanoparticles have provided benefits to numerous liquid crystal applications, while the chemistry of these nanocolloids was not fully understood. In this paper, infrared absorption spectra reveal that ferroelectric $BaTiO_3$ nanocolloids are more than $BaTiO_3$ nanoparticles in heptane with an oleic acid surfactant as previously believed. It is shown that ball-milling plays a bigger role than just a top-down approach for creating nanoparticles; it also is a means of mechanochemical synthesis. This paper demonstrates that mechanochemical synthesis is responsible for converting a large amount of the oleic acid to a metal carboxylate compound. This suggests that one cannot treat the oleic acid as a mere surfactant when considering new methods/recipes to improve fabrication processes for creating highly ferroelectric nanoparticles or when exploring the various effects that the organic additives may have on liquid crystal systems.

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