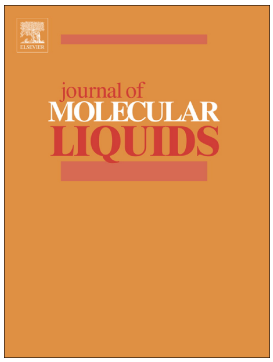

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Optical and X-ray scattering studies of the electric field-induced orientational order in colloidal suspensions of pigment nanorods

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Abstract:
Under pulsed or a.c. electric fields, colloidal suspensions of nanorods can show strong electro-optic effects, such as the Kerr effect, with fast response times (a few ms), which makes them good candidates for some commercial applications. For this purpose, suspensions of Pigment red 176 nanorods in dodecane were recently developed and their physical properties have been studied. We report here on the investigation of the orientational order induced by electric fields in isotropic suspensions of pigment nanorods by three different techniques: transient electric birefringence, transient electric dichroism, and in-situ small-angle X-ray scattering under electric field ("Electro-SAXS"). We show that, in spite of the apolar character of the solvent, the Maxwell-Wagner-O'Konski mechanism (i.e. the polarization of the counter-ion cloud around each particle) is responsible for the field-induced alignment of the nanorods. Although the particles are only weakly charged and the dielectric constant of dodecane is low, the pigment nanorods effectively behave as metallic particles in an insulating matrix and reach strong values ($S \sim 0.5$) of the induced nematic order parameter at moderate field amplitudes (~ 1 V/μm). This study confirms the feasibility of using suspensions of Pigment red 176 nanorods in dodecane for electro-optic applications.

Keywords
Transient electric birefringence; transient electric dichroism; colloids; nanorods; field-induced order