Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

Peculiarities of the magneto-optical response in dispersions of anisometric pigment nano-particles

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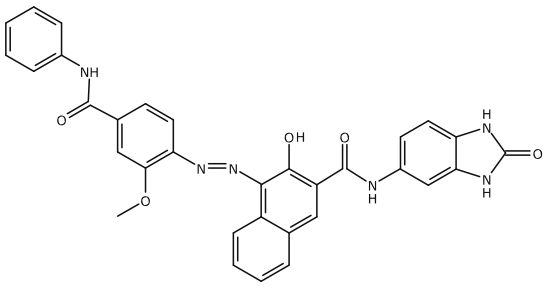
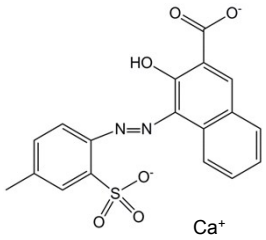
Materials

Two types of pigment materials were used to prepare the colloidal dispersions: Permanent Rubine and C.I. Pigment Red 176. C.I. Pigment Red 176, a blue shade benzimidazolone pigment, with the structural formula is shown in (Fig. S1 left). One of its commercially available forms is Novoperm Carmine HF3C (Clariant, Frankfurt am Main, Germany used as received). The primary particles are elongated plates with an average length of 230 ± 70 nm, width of 46 ± 20 nm and a thickness of 17.3 nm ± 8 nm. The particles have molecular weight of 573 g mol^{-1}.

Permanent Rubine (Fig. S1 right) is a yellow shade Calcium salt Red pigment consisting of platelets with an average length of 180 nm ± 81 nm, average width of 64 nm ± 22 nm and an average thickness of 12 nm ± 8 nm. Permanent Rubine is primarily used in printing inks and plastic manufacturing. The dye has a molecular weight of 425 g mol^{-1}.



Novoperm Carmine HF3C



Permanent Rubine

Figure S1. Structural formulas of the investigated pigments.

The particles were dispersed in the nonpolar solvent dodecane (Sigma-Aldrich, Hamburg, Germany; used as received) with the help of a commercially available dispersant Solsperse 11200 (Lubrizol,

Brussels, Belgium; used as received). Suspensions with pigment concentrations of 20 wt% and above were prepared by milling. Different concentrations below 20 wt % were obtained by stepwise dilution of this basis suspension. After the addition of the pigment, the mixture was milled in a planetary mill (Fritsch Pulverisette 7 premium line) using 0.3-mm yttria-stabilized zirconia beads in zirconia-lined pots for a total of 60 min at 500 rpm. Samples were centrifuged at 10000 rpm for 60 min to test the stability of the suspensions. None of the concentrations showed phase separation in particle-rich and particle-poor zones. Samples left untouched for 12 months showed neither any phase separation nor aggregation.

For doping the suspensions with magnetic particles, a commercially available ferrofluid (APG 935, Ferrotec) was used. The ferrofluid contains magnetite nanoparticles with an average diameter of ~10 nm suspended in hydrocarbons. The surfactant layer thickness can be estimated to be ~2 nm. To obtain homogeneous mixtures, three cycles of ~3 min each in an ultrasonic bath were performed. The dispersions were diluted with dodecane to obtain the desired particle volume fractions.

Characterization techniques

Characterisation of the particle structure was made using X-ray, Atomic Force Microscopy and Scanning Electron Microscopy (SEM). SEM studies were made with an Oxford LEO 1550VP field emission scanning electron microscope. Using this technique, resolutions of the order of 5 nm are possible. To improve the contrast and spatial resolution of the images, a thin carbon coating was applied to the probes. AFM measurements were performed using a Nanoscope IIIa (scanning probe microscope controller, Model no. MMAFMLN) (Veeco Metrology Group) in Tapping mode at 300kHz with silicon-tips. The maximum scan rate was 0.2–0.4Hz. The sample was measured at room temperature and ambient conditions. The position of the cantilever against the microscopic texture was controlled by a built-in microscope.