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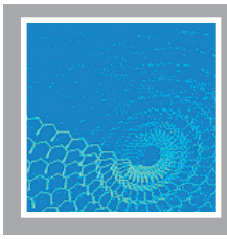

# Polymer and Colloid Highlights

## Division of Polymers and Colloids

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## Preparation of Organic Nano-Particles for Electrophoretic Displays (e-Paper)

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Electrophoretic displays have been the subject of intense research and development, recently. Advantageous attributes compared to conventional displays are good brightness and contrast, low power consumption, and a wide viewing angle like conventional paper prints. While the realization of such color displays is problematic,[1] present research represents an important step towards their realization (Fig. 1). In the initial state the blue-colored and positively charged particles are randomly distributed within the unpolar dielectric medium. After a short current pulse, the particles migrate to the transparent cathode on the top and a blue color becomes visible. The highly viscous unpolar medium retards the random back diffusion in the off stage, and thus the image stays for quite a while (middle image). If the polarity is reversed, the particles migrate to the bottom and the image disappears (bottom image).

Several physical prerequisites have to be met for a proper set-up, such as the ζ-potential of the particles, the dielectric constant of the medium, and its viscosity. The size of the colored particles should be within the range of 25 to 100 nm. Additionally, they should exhibit a high color strength and charge loading for the whole trichromatic color range. We designed the preparation of blue, magenta and yellow particles (Fig. 2 for magenta). An appropriate monomer (*e.g.* butyl acrylate), a crosslinker, and a polymerizable neutral dye precursor (*e.g.* the 1,5-diketone) are copolymerized in an emulsion polymerization to form a neutral colorless intermediate particle of about 28 nm in size.

This material is then cyclized to a pyrilium intermediate and then reacted with a series of amines to form the desired magenta nano-particles. R1 and R2 make the particles more compatible with the dielectric medium. Generating charge and color in a single step at a time proved to be key for generating the desired features of the particles.

Highly monodisperse and stable particles of the desired colors (including blue and yellow) are prepared. In various cases the counter ion $X^-$ has been exchanged in a final step to enhance the mobility of the particles.

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[1] T. H. Kim, Y. S. Ko, Y. K. Kwon, *J. Nanosci. Nanotechnol.* **2006**, *6*, 3450.

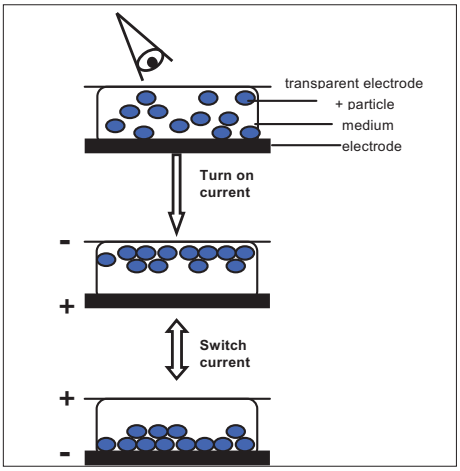


Fig. 1. Working mode of e-paper (one pixel depicted).

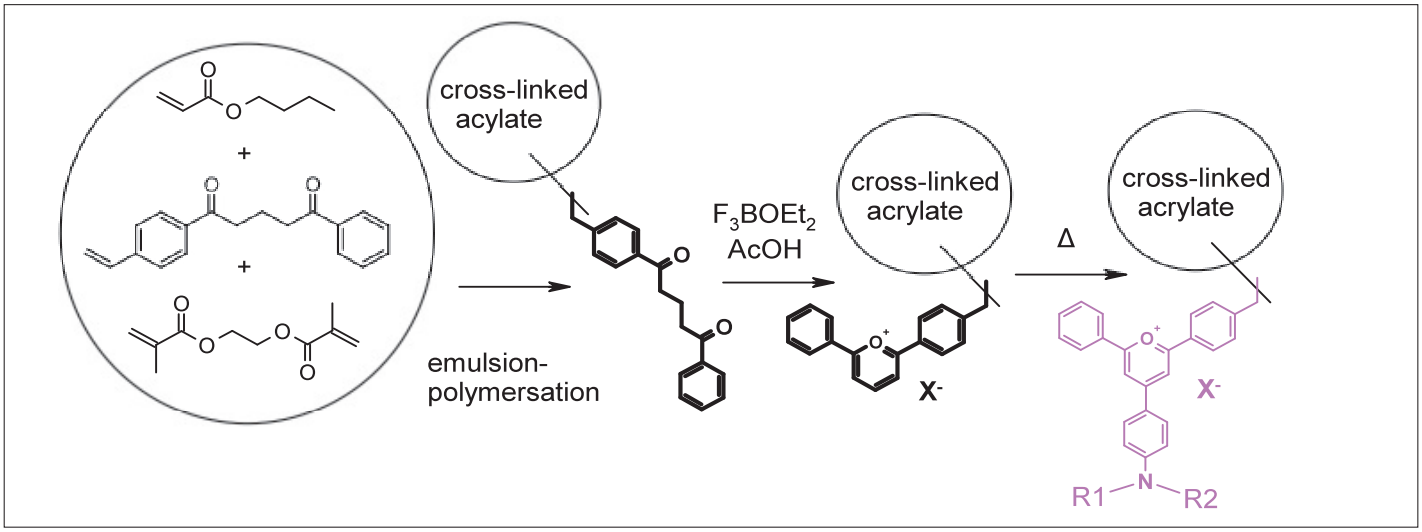


Fig. 2. Preparation of magenta particles.

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