

FUNCTIONAL MICROPARTICLES FOR ELECTROPHORETIC DISPLAY FLUIDS

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Invented in 1972 by Ota, the electrophoretic display has found commercial success in e-reader devices such as the Amazon Kindle™¹. A non-aqueous colloid of oppositely charged black and white pigment microparticles, held in a matrix of microcapsules acts as the filling between two conductive display substrates. On application of an electric field at the individual pixel level, it is possible to address the colloid such that, depending on the direction of the applied field, either white or black particles appear to the viewer. Thus is the principle of the Amazon Kindle display.

Whilst this device is very good for showing black and white images, it is not so good for showing multi-colour images. Some progress has been made towards colour by use of an overlaid colour filter or by use of a third colour particle in the fluid, but these concepts have limitations in performance and user acceptance in devices. Thus, because there is still a demand for a bright, full colour reflective display with paperlike appearance for signage applications, the challenge to develop materials for novel pixel architectures, that can produce superior colour performance remains.

This paper will summarise the recent developments in the field of novel designs for electrophoretically active particles at Merck and in the wider field. Several different particle templates will be discussed and exemplified, such as pure polymer, core shell pigment / polymer and emulsion solvent removal types. The key parameters for optimum use in an electrophoretic fluid will also be discussed. These include size control, polydispersity, charge sign, stability and magnitude, plus the tendency to remain as monodisperse particles without aggregation in a non-aqueous media, where the primary stabilisation mechanism is steric, rather than electrostatic.

The paper will demonstrate several examples of electrophoretic particles being used in fluids and show their potential for use in future new display application fields, such as digital signage, wearable displays and “smart windows”.
