

EFFECT OF CONCENTRATION OF ANILINIUM IONS IN THE SYNTHESIS OF MULTI-LAYER POLYANILINE ASSEMBLIES IN BENTONITE CLAY

J.S.H.Q. PERERA, R.M.G. RAJAPAKSE, D.T.B. TENNAKOON, C.H. MANORATNE
AND D.M.M. KRISHANTHA

Department of Chemistry, Faculty of science, University of Peradeniya

In a previous publication, we presented a novel method for the synthesis of multi-layer polyaniline assemblies in Bentonite clay[1], where Na⁺-exchanged Bentonite was subsequently cation exchanged with anilinium ions. The anilinium ions thus exchanged were polymerised to obtain the emeraldine salt form of polyaniline within Bentonite clay. The inclusion of the polymer within the clay matrix has been confirmed by X-ray diffraction studies of composite films as functions of humidity and temperature ($d = 12.6 \text{ \AA}$ at $150 \text{ }^\circ\text{C}$). The polymer thus obtained was neutralised and the cations thus inserted were exchanged again for anilinium ions and subsequently polymerised. By the successive repetition of the above procedure, we were able to load up to three layers of polyaniline within interlayer spaces of clay ($d 14.8 \text{ \AA}$ at $150 \text{ }^\circ\text{C}$) to obtain alternate insulator-conductor-insulator type of quantum well structures.

Interestingly, the ability to incorporate anilinium ions within the interlayer spaces of clay depends strongly on the concentration of anilinium ions in the solution used to achieve the exchange equilibrium. At high concentrations (e.g., 1.0 mol dm^{-3} anilinium chloride), the exchange of anilinium for inter-layer cations in the clay takes place readily with facile subsequent polymerization. Thus several layers of polyaniline were reloaded within the interlayer spaces of clay. However, at low concentrations (e.g., 0.1 mol dm^{-3} anilinium chloride), no detectable exchange of anilinium ions or the polymer formation occur within the interlayer spaces of the clay (9.98 \AA at $150 \text{ }^\circ\text{C}$).

Thus, two types of composite Bentonite-Polyaniline composite materials could be formed depending on the concentration of monomer used; those containing polyaniline adsorbed only on to the surface and those containing polyaniline within interlayer spaces as well as on the surface sites. The above effect of concentration of the monomer on the nature of the final product suggests that the filling of inter-layer sites takes place only after the saturation of surface sites of the clay.