Tethered Ferrocenes at Clay-Modified Electrodes: Effect of Clay Charge on Capacitance

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Charge transport in the interlayer region of clay platelets has been difficult to achieve due to adsorption of organic electroactive complexes driven to the clay surface by hydrophobic effects. More water soluble species apparently move within the interlayer regime, but are often not retained within the film. In order to make use of the templating capacity of layered clay films we have tethered ferrocene compounds of various chain lengths to SWy-1 Montmorillonite by use of an ammonium head group. We have found that depending upon the chain length with respect to the Debye length of the clay charge the ferrocenes can communicated in such a way as to greatly enhance the capacitance of the clay film. Results, were, however, highly variable, and the success rate of preparing enhanced capacitive materials low.

In this study we demonstrate that changing the charge on the clay alters both the number density of ferrocenes which can be retained by the clay and the Debye length of the clay surface electric field. As a result enhanced capacitive nanocomposites can be made with a large success rate and under predictable conditions (chain length to Debye length).