INSIGHT INTO NANOPARTICLE CHARGING MECHANISM IN NONPOLAR SOLVENTS TO CONTROL THE FORMATION OF PLATINUM NANOPARTICLE MONOLAYERS BY ELECTROPHORETIC DEPOSITION

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Electrophoretic deposition of nanoparticles is considered to be one of the convenient methods for preparation of ordered nanoparticle monolayers. By using a nonpolar suspension of nanoparticles, we can (a) limit the current between the electrodes; (b) reduce the changes in the composition and conductivity of the medium due to the generation of charged species near the electrodes; and (c) suppress electrochemical reactions at the electrodes. One of the important questions about understanding the principle mechanisms of electrophoretic deposition is to identify the origin of electric charge in nonpolar suspension from which the nanoparticles are deposited. We developed a simple model of nanoparticle charging and we explained how the amount of the charge carried by nanoparticles can affect the quality of deposited monolayers. For electrophoretic deposition, we used silicon substrates as electrodes and Pt nanoparticles in water-AOT-isooctane reverse micellar system as a suspension. We used the centrifugation of Pt in combination with DLS measurements for controlling the charge carried by nanoparticles. Prepared nanoparticle monolayers were analyzed by AFM, SEM and electrical measurements.

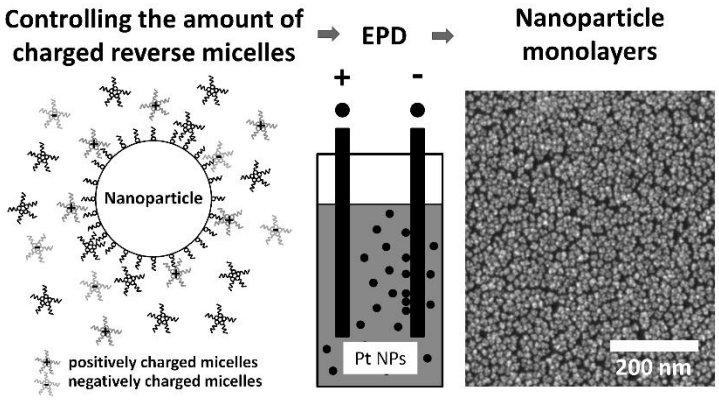

Figure 1 – the structure of colloid suspension. Empty reverse micelles, some of which are charged, are adsorbed on the surface of Pt nanoparticle and, therefore, they can introduce a charge on this particle. Controlling the amount of empty reverse micelles in the suspension can improve the deposition process which leads to the monolayer formation.