Reactive Polymer-Metal Nanocomposites: Dramatic Changes of Surface of Polymer Morphology after Intermatrix Synthesis of Metal Nanoparticles.

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Intermatrix synthesis (IMS) technique coupled with the Donnan Exclusion Effect (DEE) can be successfully applied for the modification of reactive polymers with Functional Metal Nanoparticles (FMNPs). This IMS-DEE version of IMS technique results on the most favourable distribution of FMNPs near the surface of the obtained polymer-metal nanocomposite materials (PMNCMs) (see Fig. 1a). This type of FMNPs distribution in PMNCM is particularly important in their practical applications in such fields as catalysis and electrocatalysis. At the same time modification of the surface of reactive polymers results in dramatic changes of their surface.

In this communication we report the results obtained by the modification of reactive polymers such as, ion exchange materials with mono- or bi-metallic Functional Metal NanoParticles (FMNPs) having biocide, catalytic or electrocatalytic properties. The bi-metallic FMNPs consist of a ferromagnetic core coated with a functional metal shell, which provides the final polymer-metal nanocomposite with desired functionality. The ferromagnetic nature of the metal core allows the prevention of possible undesirable escape of FMNPs into the medium under treatment by using simple magnetic traps.[1]

The modification of polymeric ion exchangers of gel type with FMNPs by using IMS-DEE technique has been shown to result in the appearance of worm-like structure on the surface of the final PMNCM (see Fig.1b). This changes in the morphology of PMNCM leads to the appearance of nanoporosity what enhances their mass-transfer characteristics. The IMS-DEE technique consists of: 1) immobilization (sorption) of metal or metal complex ions (FMNP precursors) onto the functional groups of the polymer, and 2) their chemical or electrochemical reduction. [2, 3]

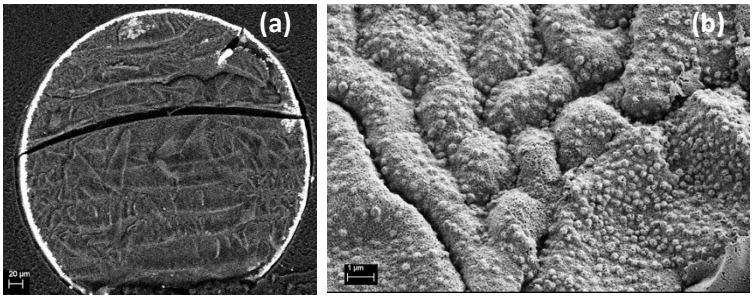

Figure 1. SEM images of PMNCM obtained by modification of cationic resin Purolite® C100E with Pd-FMNPs. (a) PMNCM bead cross-section and (b) PMNCM bead surface.

References:

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[2] P. Ruiz, M. Muñoz, J. Macanás, and D. N. Muraviev**: Intermatrix Synthesis of Polymer−Copper Nanocomposites with Tunable Parameters by Using Copper Comproportionation Reaction.** *Chemistry of Materials* 2010, **22**(24)**:** 6616-6623.

[3] D. N. Muraviev, P. Ruiz, M. Muñoz, and J. Macanás, **Novel strategies for preparation and characterization of functional polymer-metal nanocomposites for electrochemical applications.** *Pure and Applied Chemistry 2008,* **80**(11)**:** 2425-2437.