CATALYTIC ACTIVITY AND SURFACE ANCHORING OF POLYMERIC CARRIERS CONTAINING METAL NANOCATALYSTS

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This study is concerned with the investigation of the catalytic properties and the attachment of metal-nanoparticle-containing electrostatically stabilized polymeric microgel particles based on poly(acrylic acid), PAA, poly(methacrylic acid), PMAA, and poly(2-(diethylamino)ethyl methacrylate), PDEAEMA, onto inorganic surfaces [1]. These microgels have been synthesized as hosts for the impregnation of metal nanoparticles (Ru, Pd, Au etc.), which will be utilized as nanocatalysts, when attached onto the walls of microfluidic reactors, for various catalytic reactions of industrial interest.

The catalytic properties of the metal nanoparticle-containing microgel particles were investigated by using model hydrogenation reactions. The reaction products were analyzed with Ultraviolet - Visible spectroscopy (UV-Vis) [2].

The deposition of the metal impregnated microgel particles on glass substrates was investigated using Field Emission Scanning Electron Microscopy (FE-SEM) [3,4]. Their attachment was achieved after utilization of the functional groups of the microgels, such as the carboxylic acid moieties present on the surface of the microgels; these functionalities allow the binding of the carriers onto solid substrates. Various routes were followed in order to deposit the particles on the surfaces. The methodology of a Pickering emulsion was utilized, which is based on trapping the particles at the interface between two immiscible fluids. In order to increase the adhesion of the microgel particles onto the substrate surface, the samples were subjected to thermal treatment [5]. In parallel to the above procedure, an amine coupling method was introduced, which leads to the covalent binding of the microgel particles onto a glass surface (Figure 1) [6]; (3-aminopropyl)-triethoxysilane (APTES) coupling agent was used as the linker molecule. The durability of the surface bound microgel particles against hydration and shear forces was tested utilizing repeated immersion of the surfaces into water undergoing mechanically-generated hydrodynamic flow.

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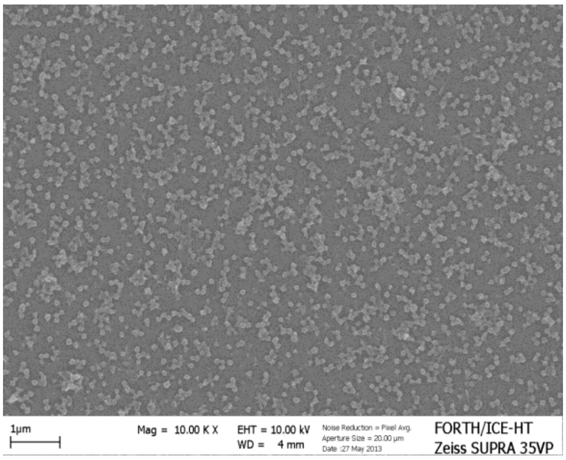

Figure 1: PMAA/Pd nanocatalysts immobilized onto a glass substrate by an amine coupling method.

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