Synthesis and Properties of the Copper Composite Membranes

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Composite catalysts based on track-etched membranes (TeMs) and metal nanoparticles (NPs) or nanotubes (NTs) deposited by different approaches have drawn a special attention because of attractive catalytic properties coupled with large catalytically active surface, high mechanical strength and efficient flexibility, which allows them to be successfully used for several reaction cycles without additional manipulation of purification and activation.

In most works devoted to the study of the catalytic properties of nanoscale systems, the most popular reaction is the reduction of p-nitrophenol (4-NP) in the presence of the sodium borohydride [1]. Using this benchmark evaluation reaction the catalytic properties of composites based on TeMs and different types of NPs or NTs [2,3]. Despite the simple control of the 4-NP reduction process, this reaction has a great industrial importance in the production of organic dyes, additives to polymer materials and motor fuels, the synthesis of biologically active substances, pharmaceutical substances et al. From another hand 4-NP is an extremely toxic pollutant in industrial wastewater streams causing a wide range of human disease. Therefore, developing an efficient and cost-effective catalyst for the degradation of 4-NP is a relevant problem both for industry and environmental protection.

In the present study, we evaluate the effects of composition and temperature of the plating solution, deposition time, as well as polymer template pretreatment on the structure and properties of the composite based TeMs with embedded copper NTs. The statistical analysis was also used to understand the influence of the copper NTs fabrication parameters on the composites structure and the optimal combination of fabrication parameters to obtain the maximum thin walled stable copper NTs with high catalytic activity was proposed.

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