ENVIRONMENTALLY SAFE UTILIZATION OF TOXIC CHLORINATED COMPOUNDS USING NANO-SIZED NI AND PD CONTAINING CATALYTIC SYSTEMS

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Toxic polychlorinated substances are formed as the wastes during large-scale production of chlorinated organics. The only environmentally safe and universal method of chlorinated hydrocarbons processing is catalytic hydrodechlorination in the presence of VIII Group metals. The development of this method needs in the elaboration of new catalysts having high stability and low production costs.

In this work new nanostructured catalytic systems for hydrodechlorination have been elaborated, that combine very low metal content (0.01-0.001%) and high activity and stability. Elaboration of these systems is based on the recently found phenomenon – the dependence of the catalytic activity on the average distance between active particles on the support due to interaction between supported metal clusters [1]. Laser elecrtodispersion technique [2] was used to prepare supported Pd and Ni nanoparticle films on Si, SiO_2 and Sibunit (carbon). These films consisting of densely packed aggregates (ensembles) of granules become conducting due to electron tunneling between nearby granules. Inter-grain electron tunneling leads to a redistribution of charges and to formation of a significant amount of the charged particles within ensembles. These charged states provide unique catalytic properties of nanostructured films. Purposive formation of 2 nm – sized metal particles with optimal inter-cluster distance on the support makes possible to improve catalytic activity up to three-four orders of value in comparison with similar catalysts, prepared by traditional methods, and increase significantly durability of the catalysts.

Catalytic samples were tested in butch and continuous flow type systems and demonstrated very good performance in hydrodechlorination of chlorinated aromatics in gas and liquid-phase conditions [1, 3]. For example, Pd and Ni nanoparticles deposited on silicon supports (SiO_2/Si) or

Sibunite (C) granules are very active in gas phase and multiphase hydrodechlorination of chlorobenzene at 100 - 250°C. Pd catalysts with very low metal content (10^{-4} – 10^{-3}%mass.) are several orders of magnitude superior in activity than usual supported metal catalyst (0.5% Pd/UDD). 2×10^{-3}%Ni/Sibunit catalysts have twofold better activity in comparison with 0.01%Pd/Al_2O_3. Ni catalysts are stable during the feed of 2.3×10^{4} M chlorobenzene /1 M Ni at 30-50%conversion.

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