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Editorial

Ni-Based Catalysts: Synthesis and Applications Today

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Transition-metal-based catalysts are widely used in various processes, in particular—nickel-based catalysts. They started to be developed from the late 19th century due to their ability to catalyze reactions with hydrogen in hydrogenolysis reactions [1]. The presence of an unfilled 3d orbital allows them to interact with hydrocarbon electrons, thereby enhancing their dissociation [2].

Currently, a lot of research studies are devoted to the investigation of nickel-based catalysts, which is reflected in many review articles on the various catalytic processes. On the one hand, nickel-based catalysts are well known for oil refining processes, fat hydrogenation, etc. On the other hand, nickel-based catalysts attract attention for their use in promising technologies of the future with different levels of technological readiness. The rapidly developing processes using Ni-based catalysts are biomass conversion into fuel components and additives, methane decomposition for hydrogen production or hydrogen evolution in liquid organic hydrogen carrier (LOHC) technology as well as electrocatalysis, CO_2 hydrogenation and many others.

This Special Issue presents a limited number of Ni-based catalyst applications. The increasing requirements for fossil-derived fuel has led to the need for hydrotreatment catalysts. The Special Issue contains several papers on the conventional applications related to the petroleum refining industry. The first one describes development of novel trimetallic Ni—Mo—W unsupported catalysts for vacuum gasoil hydrotreatment with an emphasis on the hydrodesulfurization and hydrodenitrogenation reactions [3]. Besides applications, catalyst regeneration or remanufacturing is another very important task to maintain the catalysts in operation as long as possible. To this end, Ahn et al. investigated remanufacturing of the spent Ni-Mo catalyst for residue hydrodesulfurization [4].

New applications of Ni-based catalysts include the conversion of biomass-derived products into chemicals and biofuel components. Philippov et al. investigated bimetallic Ni-Cu catalysts in bio-oil model compound (anisole) hydrotreatment in isopropanol media as a solvent and a hydrogen source to produce hydrogenated derivatives [5], while Xu et al. investigated classic Raney nickel (both original and modified) in a two-step esterification–hydrogenation of the bio-oil light fraction to upgrade it [6]. Another application of Ni-based catalysts in the conversion of a biomass-derived substrate into a platform chemical was demonstrated by Stepanova et al. They have studied a catalyst series based on Ni(Mg)Al-layered hydroxides in furfural hydrogenation [7]. Also, similar system was shown to be promising for hydrogen evolution reaction. Fedorova et al. investigated Ni-Mg-Al hydroxide-derived catalysts for decomposition of ammonia as one of the promising compound for hydrogen transportation [8]. The hydrogen evolution reaction (HER) is an important process that has recently been attracting much attention. A feature paper of special issue is devoted to the study of the composite synthesis of $Pt_{1-x}Ni_x$ (x = 0.0–1.0) cnanoparticles embedded in carbon nanofibers (CNF) and their application in the HER electrochemical process [9].

Thus, catalysts based on nickel, as it is clearly demonstrated by the papers in this Special Issue, have a great potential for further development in the future.

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