

as redox activities, compared to undoped ceria. An accent was put also on the synthesis of nanosized ceria as an important factor for the preparation of highly active gold supported catalysts. The object of this study is to synthesize new gold catalysts supported on ceria and ceria-alumina non-promoted and promoted by molybdena for complete benzene oxidation. The catalysts were characterized by means of XRD, TPR, XPS and Raman spectroscopy. High and stable catalytic activity was established in the temperature region 200-2400C. The presence of gold causes a modification in ceria structure leading to an increase of Ce³⁺ and oxygen vacancies formation. The differences in the activities within the temperature range 150-1800C and in the region of 100 % conversion (200-2400C) could be explained by supposing that in the LT region the electron transfer between nanosized gold and ceria particles via oxygen vacancies has a crucial role. In the HT region the oxygen mobility, provoked by the defective structure of ceria due to the presence of Al³⁺, becomes of prevailing importance. It was also concluded that alumina prevents the gold and ceria agglomeration, which is the main factor to avoid deactivation under extreme reaction conditions.

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Determination and fine tuning of the cerium oxidation state in cerium calixarene complexes

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Interesting structures and properties as well as perspectives of practical use motivated intensive studies of various calixarene complexes in recent years. The development of new catalysts increases also the interest in the design and synthesis of supramolecular metalocalixarene arrays. The novel cerium calixarene complexes [p-tBu-calix[4](OMe)₂(O)₂Ce(acac)₂] (1) and [p-tBu-calix[4](OMe)₂(O)₂Ce(hfac)₂] (2) were recently synthesized in an equimolar reaction between p-tBu-calix[4](OMe)₂(OH)₂ and cerium complexes Ce(acac)₄ (acac = acetylacetonate), and Ce(hfac)₄ (hfac = 1,1,1,5,5,5-hexafluoro-acetylacetonate), respectively [1].

The cerium oxidation state in such complexes is discussed intensively, whereas contradictory results are reported [2]. In the present study, X-ray photoelectron spectroscopy (XPS) with monochromatic Al K α excitation (1486.74 eV) was applied in a "fast transfer" mode [3]. The experiments revealed an irradiation-induced decrease of the Ce_{ox} values of both complexes dependent upon X-ray exposure. The detailed study of the dynamical response of the Ce_{ox} to X-ray irradiation allowed the determination of Ce_{ox} at "zero irradiation" [3.60 for complex (1) and 3.65 for complex (2), respectively]. Neither vacuum-induced reduction, nor re-oxidation of the irradiated compounds in air were observed suggesting the possibility of the long-lasting X-ray induced tuning of Ce_{ox} in a range of at least 3.65 to 3.26.

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Preparation of VPO-catalysts on supports of different nature

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Vanadium-phosphorus oxide systems (VPO) are catalysts for oxidative transformations of hydrocarbons. Vanadyl hydrophosphate (VHP), precursor of catalyst, is not formed as a rule at deposition of VPO on supports. It was offered following new pathways for preparation of mesoporous supported VPO-catalysts by means barothermal synthesis (BTS) in organic and aqueous medium under 170 C: 1) introduction of nonporous fumed oxides or carbon nanotubes in reaction mixture on various stages of VPO synthesis; this route permits to obtain needed phase and to regulate its porous structure in wide limits; first it was prepared supported VPO-catalysts aerogel type on base of C-nanotubes; 2) precipitation on porous solids of different nature: silica gel, phosphates of Ti and Zr, active carbon; in latter case synthesis was carried out in aqueous medium without reducing agent; 3) deposition on preliminary modified silica with organic grafted layer which is potential reducing reagent at VPO preparation; such supported catalysts have residual organic groups on surface which are thermostable on air to 350 C; synthesis of VPO on oxidized carbon allows to increase both loading of active phase and its dispersity in two times; 4) mechanochemical deposition of ready VHP on fumed oxides and phosphates. All suggested approaches permit to prepare on surface of supports necessary phase of VHP in nanodisperse state; size of crystallites according to XRD data has following values: 33-35 nm for bulk samples, 30 nm for method 4, 23-26 nm for method 1, 20 nm for method 3, 6-15 nm on carbon surface. VHP is formed with various relation for intensities of crystalline patterns of (001) and (220) planes: 0,39-1,69. This relation determines primary surface orientation of planes and hence catalytic properties of VPO in diverse processes.

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Synthesis and Electrochemical Characteristics of Highly Dispersed Platinum Nanoparticles on Different Carbon Supports for PEMFC

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Commercial XC-72 carbon black, multi-wall carbon nanotube (MWCNT), and bamboo charcoal were used as carbon supports for Pt catalyst for application in proton exchange membrane fuel cell (PEMFC). Due to the unique morphology of carbon nanotube, there are less geometric barriers than XC-72 for deposition of Pt. Accu-