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Vanadium oxide supported on mesoporous SBA-15 modified with Al and Ga as catalysts in ODS of DBT

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In order to adapt current processes to the strict regulatory requirements, several technologies have been developed for deep desulfurization of diesel fuel. The major portion of sulfur in light cycle oils (LCO) is found in dibenzothiophene (DBT) and alkyl-dibenzothiophenes, which are not easily removable by hydrotreating, because they require high pressure and hydrogen consumption. Vanadium oxides supported on mesoporous SBA-15 catalysts with different vanadium loadings were studied in the oxidative desulfurization (ODS) of dibenzothiophene as a model sulfur compound. The catalytic activity was improved when SBA-15 framework was modified with Al and Ga as heteroatom substituting framework Si. Structural and textural characterization of the catalysts were performed by means of XRD, N_2 adsorption, UV–Vis–DRS, XPS, NMR, TEM, Raman, TPR and Py-FTIR. UV–Vis–DRS and Raman demonstrated that highly dispersed vanadium VO4-3 species are responsible for the high activity in the sulfur removal. The Ga modified support with an intermediate V/Si ratio of 1/30 was the most active catalyst for ODS of DBT, using hydrogen peroxide as oxidant and acetonitrile as solvent. 100% of DBT elimination was attained at a short time in mild conditions. Gallium and aluminum incorporation into the support modified successfully the nature of the SBA-15 surface by generating Bronsted and Lewis acidity. The interaction between the acid sites with the active vanadium sites improved the activity of the catalysts. The high dispersion depended on the vanadium loading and on the nature of the support. The more acidic support allowed better dispersion of the vanadium species due to stronger interaction metal-support. The reusability of the catalysts indicates that vanadium oxide supported on mesoporous SBA-15 modified with Ga and Al are potential catalysts for the ODS of dibenzothiophene.

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Ionizing radiation induced functionalization of polymeric materials

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Radiation processing techniques are based on the physical interaction of radiation with matter which is capable of promoting specific chemical reactions. In particular, gamma irradiation, a clean and environmental friendly technology; as there is no need of solvents, initiators or high temperatures, leading to no residues; has been successfully applied over the years in the preparation/modification of polymers. By suiting the experimental conditions like irradiation method, dose rate, irradiation atmosphere, samples' absorbed dose, reactants' concentration, etc., it is possible to functionalize polymeric based materials, tailor its properties and adequate them to different applications (mainly through polymerization, crosslinking and/or grafting reactions). In this presentation, the methodology that our team have been carrying out on the development/functionalization of chitosan based matrices and PVA based membranes respectively for biomedical applications (drug release systems and wound dressings) and for catalysis (polymeric catalytic membrane reactors for production of valuable compounds as aromas and biodiesel), using gamma-radiation as a modifying tool will be highlighted.

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