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EXAFS study of Ni-M supported systems for catalytic reforming of methane

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The study of Supported nickel nanoparticles systems has gained interest in the last years because of its high performance in dry reforming of methane (DRM) to produce syngas, used for several liquid hydrocarbon production (Fischer-Tropsch processes), or to obtain hydrogen, by purification of syngas, promising to become one of the major sources of energy in the near future. Coke formation by methane decomposition or by Boudouard reacction has a negative influence on catalyst stability. A good active phase dispersion in the support surface could reduce the particle size and it limit carbon formation [1]. Some studies for avoiding the coke deposition in Ni based catalysts are related with doping with noble metals or by oxidative effect of basic promoters. CeO2 is reported in this way for several authors [2,3]. The mechanism by which the basic promoters like CeO2 limit deactivation on Ni catalysts is that the Ni forms a closely bonded structure or alloy with the promoting metal, which preferentially forms C-O bonds instead of C-C bonds, which helps in oxidation of surface carbon [4]. Furthermore, the presence of CeO2 in strong interaction with nickel metal nanoparticles could lead to effects in the metallic particle shape during the reaction with possible consequences in the performance of the reaction [2].

We propose the study of nickel nanoparticle systems, and modified systems with CeO2, supported on high specific surface mesoporous silica using different methods of preparation to clarify differences in structure and particle size of the catalytic active phase and its consequences in DRM activity.

References

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