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The effect of doping NiMgAl catalysts with lanthanum on the dry reforming of methane

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The dry reforming of methane is a prospective process that can be used for the valorisation of the greenhouse gas; carbon dioxide. It also produces syngas suitable for use in Fischer-Tropsch oxygenated compounds syntheses. The main issue with this process is that the catalysts used are quickly deactivated by coke formation. Many studies focus on finding a catalyst that can resist deactivation. Hydrotalcite catalysts are stable and active in the dry reforming of methane. Moreover, the addition of lanthanum to the hydrotalcite composition improves catalytic activity. $Ni_xMg_{6-x}Al_2$ and $Ni_xMg_{6-x}Al_{1.8}La_{0.2}$ (x = 2, 4 or 6) catalysts were prepared via the hydrotalcite route. The XRD showed that the calcined $Ni_xMg_{6-x}Al_{1.8}La_{0.2}$ catalysts contained different lanthanum oxide species. The FTIR spectra demonstrated that lanthanum doped catalysts adsorb more CO_2. TPR analyses proved that the addition of lanthanum affected nickel species distribution in the catalysts and strengthened NiO-MgO interaction inside the solid matrix. The CO_2 reforming of methane reaction ($Ar/CO_2/CH_4$:60/20/20; GHSV 60000 $mL.g^{-1}.h^{-1}$) was carried out in the 600oC to 800oC range. Lanthanum addition improved the catalytic activity especially by favoring the dry methane reforming reaction over all other secondary reactions in addition to the creation of more basic sites that enhance CO_2 adsorption and contribute to carbon deposits removal. The most active lanthanum containing catalyst kept a constant catalytic performance for 14 hours on stream regardless of the formation of carbon deposits. These deposits can be removed under oxidative atmosphere at moderate temperature due to the presence of lanthanum oxide species in the catalyst.

Biography

S Aouad has completed his PhD in 2007 from "Université du Littoral – Côte d'Opale", France and is currently an Associate Professor of Physical Chemistry at the University of Balamand, Lebanon. He has published more than 30 papers in reputed journals and has been an "Invited Professor" several times at European Universities. He has been awarded funds for several national and international projects and he also serves as a scientific committe member of the JFL conference series.

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