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掺杂La^{3+}对纳米Au/TiO_2催化剂结构和性能的影响

Effect of La^{3+} Doping on the Structures and Performance of Nano-structured Au/TiO_2 Catalysts

中文关键词：纳米金催化剂；一氧化碳氧化；介孔二氧化钛；P123模板剂；掺杂；La^{3+}

英文关键词：nano-structured gold catalyst; carbon monoxide oxidation; mesoporous titania; P123 template; doping; La^{3+}

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中文摘要：

采用三嵌段共聚物聚乙醚-聚丙醚-聚乙醚$EO_{20}PO_{70}EO_{20}$(P123)为有机模板剂分别合成了纯的和掺杂少量La^{3+}的介孔TiO_2载体，用沉积-沉淀法制得负载金催化剂。运用N_2吸附-脱附(BET)、X射线衍射(XRD)、X射线光电子能谱(XPS)、高分辨电镜技术(HR-TEM)和X射线能量分散谱(EDX)对催化剂的结构与形貌进行了表征。BET结果表明，采用P123为模板剂

英文摘要：

The mesoporous TiO_2 and La-TiO_2 were synthesized by using P123 as an organic template, and the supported gold catalysts were prepared by using deposit-precipitation method. The N_2 adsorption-desorption, XRD, XPS, HR-TEM and Energy Dispersive X-ray (EDX) analysis techniques were employed to characterize the structures of the catalysts. The results of N_2 adsorption-desorption show that the synthesized TiO_2 possesses high surface area (103 $m^2 \cdot g^{-1}$) and uniform mesoporous structure with the pore size mainly centered at ~4.1 nm. With the doping of La^{3+}, the surface area and the pore size of La^{3+} doped mesoporous TiO_2 increase to 122 $m^2 \cdot g^{-1}$ and ~4.9 nm, respectively. After calcination at 450 ℃, the mesoporous structure of Au/TiO_2 has collapsed partly, while that of Au/La-TiO_2 is well maintained. The gold in Au/TiO_2 calcined at 450 ℃ exists as AuO, but in La^{3+} doped catalyst there is a small portion of Au_2O_3 in addition to AuO. The results of HR-TEM show that after calcination at 400 ℃, the crystallite sizes of Au in Au/TiO_2 and Au/La-TiO_2 are 6~8 nm and ~5 nm, respectively. After calcination at 450 ℃, the Au crystallites in Au/TiO_2 increase to above 20 nm, while in Au/La-TiO_2 they still keep very small size of ~9 nm. For ambient CO oxidation, all the catalysts calcined at 400 ℃ or below exhibit excellent activity. After calcination at 450 ℃, the temperature for the full conversion of CO over Au/TiO_2 reaches 86 ℃, while the temperature is only 53 ℃ over Au/La-TiO_2. The doping of a small amount of La^{3+} effectively inhibits the sintering of Au crystallites, and therefore, makes the catalyst possess good activity and high thermal stability.

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