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N_2O在Au/Co_3O_4和$Au/ZnCo_2O_4$催化剂上的分解反应

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Catalytic decomposition of N_2O over Au/Co_3O_4 and $Au/ZnCo_2O_4$ catalysts

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摘要 通过调变$HAuCl_4$溶液的pH值和Au负载量,用沉积-沉淀法制备了一系列Au/Co_3O_4催化剂,并采用AES、BET、XRD、SEM、XPS和H_2-TPR等技术对催化剂的结构和组成进行了表征,考察了制备条件对其在有氧气氛中催化N_2O分解反应性能的影响规律,得到了催化剂最佳制备条件:$HAuCl_4$溶液pH值为9,Au负载量为0.29%。催化测试结果表明:虽然$ZnCo_2O_4$的催化活性优于Co_3O_4,但0.31%$Au/ZnCo_2O_4$的活性和稳定性低于0.29%Au/Co_3O_4。500℃、在含氧气氛中连续反应10 h, 两者均可完全分解N_2O,但在含氧、含水气氛中0.29%Au/Co_3O_4和0.31%$Au/ZnCo_2O_4$上的N_2O转化率分别为92%和63%。究其原因,发现Au/Co_3O_4中Au和Co组分间存在协同效应,而$Au/ZnCo_2O_4$中Au和Co组分间则没有协同效应。

关键词: N_2O催化分解 Co_3O_4 $ZnCo_2O_4$ 金催化剂

Abstract: Au/Co_3O_4 catalysts with different gold loadings were prepared by the deposition-precipitation method using $HAuCl_4$ solution through adjustment of the pH value to 7, 9 or 11. Their catalytic properties for N_2O decomposition in the presence of oxygen were investigated. 0.29%Au/Co_3O_4 catalyst prepared at the pH value of 9 exhibited higher catalytic activity than 0.31%$Au/ZnCo_2O_4$ prepared under optimal conditions although $ZnCo_2O_4$ was more active than Co_3O_4. AES, BET, XRD, SEM, XPS and H_2-TPR characterization results indicated a synergistic effect existed between gold and cobalt species in Au/Co_3O_4, which is, however, absent in the $Au/ZnCo_2O_4$. Despite that N_2O was completely decomposed at 500 ℃ in oxygen atmosphere for both the samples, the N_2O conversion was decreased to 92% and 63% after the reaction was carried out for 10 h in the presence of both oxygen and steam over the 0.29%Au/Co_3O_4 and the 0.31% $Au/ZnCo_2O_4$, respectively.

Key words: N_2O decomposition Co_3O_4 $ZnCo_2O_4$ gold catalyst

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