

研究论文

整体式  $\text{Co}_3\text{O}_4/\text{YSZ}-\gamma\text{-Al}_2\text{O}_3 + \text{CYZ}$  催化剂上的甲烷催化燃烧

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**摘要** 用质量比为3: 2的YSZ- $\gamma$ - $\text{Al}_2\text{O}_3$ 和 $\text{CeO}_2$ - $\text{Y}_2\text{O}_3$ - $\text{ZrO}_2$ 的混合物(以YSZA+CYZ表示)作载体, 制备了不同 $\text{Co}_3\text{O}_4$ 含量的整体式甲烷燃烧催化剂, 同时制备了分别以YSZA和CYZ为载体的催化剂作为对比, 研究了它们老化前后的反应性能, 并用BET, XPS, XRD, TPR等研究了催化剂的比表面、表面状态、晶相结构和还原性能. 结果表明, YSZ- $\gamma$ - $\text{Al}_2\text{O}_3$ 和 $\text{CeO}_2$ - $\text{Y}_2\text{O}_3$ - $\text{ZrO}_2$ 混合载体能有效地抑制 $\text{CoAl}_2\text{O}_4$ 的生成, 并能充分发挥各自的优点, 因此负载一定量的钴后表现出很高的甲烷催化燃烧活性和抗老化性, 尤其是含8 wt%  $\text{Co}_3\text{O}_4$ 的样品性能最佳, 有望成为实用的甲烷燃烧催化剂之一.

**关键词** [甲烷催化燃烧](#) [整体式催化剂](#)  [\$\text{Co}\_3\text{O}\_4\$](#)  [YSZ- \$\gamma\$ - \$\text{Al}\_2\text{O}\_3\$](#)   [\$\text{CeO}\_2\$ - \$\text{Y}\_2\text{O}\_3\$ - \$\text{ZrO}\_2\$](#)

分类号

## Methane Combustion over $\text{Co}_3\text{O}_4/\text{YSZ}-\gamma\text{-Al}_2\text{O}_3 + \text{CYZ}$ Monolithic Catalysts

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**Abstract** A series of cobalt-based monolithic catalysts supported on mixture of YSZ- $\gamma$ - $\text{Al}_2\text{O}_3$  and  $\text{CeO}_2$ - $\text{Y}_2\text{O}_3$ - $\text{ZrO}_2$  were prepared by impregnation method, and characterized by XRD, XPS, BET and  $\text{H}_2$ -TPR. Contrasting with the 8 wt%  $\text{Co}_3\text{O}_4$ -based monolithic catalyst supported on YSZ- $\gamma$ - $\text{Al}_2\text{O}_3$  or  $\text{CeO}_2$ - $\text{Y}_2\text{O}_3$ - $\text{ZrO}_2$ , the catalytic activities for methane combustion were assessed in a micro-reactor. All the mixture supported monolithic catalysts had higher activity for methane combustion than the contrast catalysts. After calcination at 1000 °C for 5 h, the monolithic catalysts remained highly active and very stable, especially the catalyst containing 8 wt% of  $\text{Co}_3\text{O}_4$  had the highest activity and methane was completely converted to  $\text{CO}_2$  at ca. 514 °C. The results showed that the mixture had the advantage of  $\text{CeO}_2$ - $\text{Y}_2\text{O}_3$ - $\text{ZrO}_2$  and YSZ- $\gamma$ - $\text{Al}_2\text{O}_3$  ( $\gamma$ - $\text{Al}_2\text{O}_3$  modified by  $\text{Y}_2\text{O}_3$  and  $\text{ZrO}_2$ ) and can resist forming the crystal of  $\text{CoAl}_2\text{O}_4$  effectively.

**Key words** [methane catalytic combustion](#) [monolithic catalyst](#)  [\$\text{Co}\_3\text{O}\_4\$](#)  [YSZ- \$\gamma\$ - \$\text{Al}\_2\text{O}\_3\$](#)   [\$\text{CeO}\_2\$ - \$\text{Y}\_2\text{O}\_3\$ - \$\text{ZrO}\_2\$](#)

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