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Ammonia decomposition over nickel catalysts supported on alkaline earth metal aluminate for H₂ production

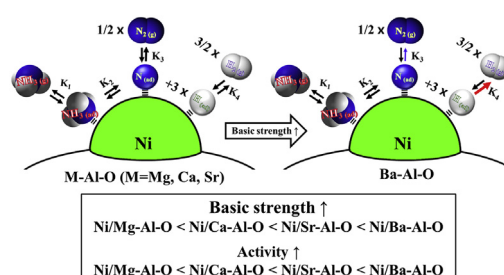
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HIGHLIGHTS

- Ni/M-Al-O (M = Mg, Ca, Sr, Ba) catalysts were synthesized for NH₃ decomposition.
- Ni/Ba-Al-O catalyst exhibited the best catalytic performance.
- Basic property of the catalysts was related to their alkaline earth metal ions.
- Strong basic property of the catalyst reduced H₂ inhibition effect.

GRAPHICAL ABSTRACT



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ABSTRACT

The Ni catalysts supported on alkaline earth metal aluminate compounds, Ni/AM-Al-O (AM = Mg, Ca, Sr, Ba) were synthesized to investigate the influence of their basic property on NH₃ decomposition activity. The basic strength of the catalysts was confirmed to correspond to that of added alkaline earth metal in the support materials (Ni/Mg-Al-O < Ni/Ca-Al-O < Ni/Sr-Al-O < Ni/Ba-Al-O) from CO₂-TPD measurement. This basic strength of the catalysts could influence the catalytic activity for NH₃ decomposition, which increased in order of the Ni/Mg-Al-O < Ni/Ca-Al-O < Ni/Sr-Al-O < Ni/Ba-Al-O catalysts. NH₃-TPSR showed that the strong basic property weakened H₂ adsorption but slightly strengthened N₂ adsorption for the catalysts except for the Ni/Mg-Al-O catalyst. From the kinetic analysis, the absolute value of the H₂ reaction order decreased with increasing basic strength of the catalysts, indicating that the strong basic property of the catalysts could alleviate the H₂ inhibition in ammonia decomposition.

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