Development of porous nickel catalysts by low-temperature Ni–Al chemical alloying and post selective Al leaching, and their application for ammonia decomposition

Yu-Jin Lee [a,b], Yong-Seok Lee [a,c], Jun Young Cha [a], Young Suk Jo [a], Hyangsoo Jeong [a], Hyuntae Sohn [a], Chang Won Yoon [a,d], Yongmin Kim [a,*], Kwang-Bum Kim [b,**], Suk Woo Nam [a,***]

[a] Center for Hydrogen and Fuel Cell Research, Korea Institute of Science and Technology, Seoul, 02792, Republic of Korea
[b] Department of Material Science & Engineering, Yonsei University, Seoul, 03722, Republic of Korea
[c] Department of Mechanical Engineering, School of Industrial and Mechanical Engineering, The University of Suwon, Hwaseong, 18323, Republic of Korea
[d] KHU-KIST Department of Converging Science and Technology, Kyung Hee University, Seoul, 02447, Republic of Korea

HIGHLIGHTS

- Ni–Al alloy powders were synthesized by a low-temperature chemical alloying method.
- Post aluminum leaching converts Ni–Al alloy precursors into porous nickel catalysts.
- Ammonia decomposition was successfully carried out using porous nickel catalysts.

GRAPHICAL ABSTRACT
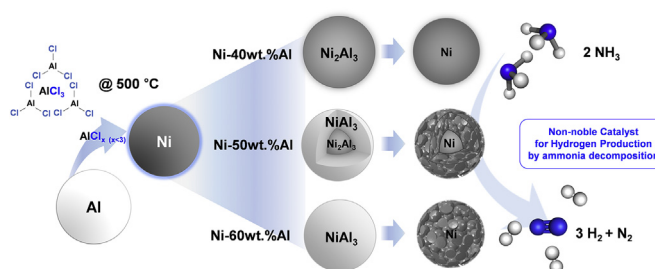
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ABSTRACT

Micron-sized Ni–Al alloy powders (Ni–x wt.%Al, x = 40, 50, 60) were synthesized using the low-temperature chemical alloying (LTCA) at 500 °C. The three different as-prepared Ni–Al alloy powders were composed of Ni_2Al_3 and/or $NiAl_3$ phases while achieving thermodynamic equilibrium compositions (Ni–40 wt%Al, Ni_2Al_3; Ni–50 wt%Al, the coexistence of Ni_2Al_3 and $NiAl_3$; Ni–60 wt%Al, $NiAl_3$). The LTCA method demonstrates that it is capable of producing Al-rich Ni–Al alloy powders while maintaining a particle size similar to that of the starting Ni particles. The three Ni–Al alloy powders were used as precursor materials to