

Production hydrogen and nanocarbon via methane decomposition using Ni-based catalysts effect of acidity and catalyst diameter

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Abstrak

Objectives of this research are mainly to study impacts of acidity strength (by varying amount of precipitant and loading Al-Si) and the effect of nickel particle size (by varying calcinations temperature) on decomposition reaction performances. In this research, high-nickel-loaded catalyst is prepared with two methods. Ni-Cu/Al catalysts were prepared with co-precipitation method. While the Ni-Cu/Al-Si catalyst were prepared by combined co-precipitation and sol-gel method. The direct cracking of methane was performed in 8mm quartz fixed bed reactor at atmospheric pressure and 500-700°C. The main results showed that the Al content of catalyst increases with the increasing amount of precipitant. The activity of catalyst increases with the increasing of catalyst's acidity to the best possible point, and then increasing of acidity will reduce the activity of catalyst. Ni-Cu/4Al and Ni-Cu/11Al deactivated in a very short time hence produced fewer amount of nanocarbon, while Ni-Cu/15Al was active in a very long period. The most effective catalyst is Ni-Cu/22Al, which produced the biggest amount of nanocarbon (4.15 g C/g catalyst). Ni catalyst diameter has significant effect on reaction performances mainly methane conversion and product yield. A small Ni crystal size gave a high methane conversion, a fast deactivation and a low carbon yield. Large Ni particle diameter yielded a slow decomposition and low methane conversion. The highest methane conversion was produced by catalyst diameter of 4 nm and maximum yield of carbon of 4.08 g C/ g catalyst was achieved by 15.5 nm diameter of Ni catalyst.