Promising hydrothermal technique for efficient CO2 methanation over Ni/SBA-15

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ABSTRACT

The comparative study of different hydrothermal treatment techniques (Reflux (R) and Teflon (T)) and without hydrothermal technique (W) towards efficient CO2 methanation over Ni/SBA-15 was discussed. X-ray diffraction (XRD), inductive coupling plasma-atomic emission spectroscopy (ICP-AES), N2 adsorption-desorption isotherms (BET), Fourier transform infrared (FTIR) spectroscopy, UV-vis diffuse reflectance spectroscopy (UV-Vis DRS), scanning electron microscope - energy dispersion x-ray (SEM-EDX), and transmission electron microscope (TEM) analysis showed that Ni/SBA-15(R) possessed fascinating catalytic properties owing to the highest surface area (814 m^2/g) and pore diameter (5.49 nm) of SBA-15(R), finest metal particles (17.92 nm), strongest metalsupport interaction and highest concentration of basic sites. The efficacy of Ni/SBA-15 towards CO2 methanation was descending as Ni/SBA-15(R) > Ni/SBA-15(T) > Ni/SBA-15(W), implying the outstanding performance of Ni/SBA-15(R) which in parallel with the characterization results. The lowest performance of Ni/SBA-15(W) was due to the poorest properties of support; lowest surface area and pore diameter, largest Ni sizes, weakest metal-support interaction and lowest concentration of basic sites. This study successfully developed fascinating Ni/SBA-15 through the reflux hydrothermal treatment technique for CO2 methanation.

KEYWORDS: Ni/SBA-15; CO2 methanation; Hydrothermal; Si-O-Ni formation