Autothermal and Tri reforming of methane at High Temperature and Elevated Pressure under nickel spinelized pellets prepared from a metallurgical residue.

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Highlights

- The potential of the Ni-UGSO pellet was studied for Autothermal and tri reforming of methane at elevated pressure.
- Modifying Ni-UGSO powder into pellets enhanced the activity, conversion, and selectivity.
- Clay addition improved the Ni dispersion, surface basicity, and metal support interactions.
- The formation of oxygen vacancies in the Ni-UGSO pellet improves the coke gasification in Autothermal and tri reforming of methane from 1-10 atm at 850 ^{o}C

This work evaluated the performance of Ni -UGSO pellet in the Autothermal and tri-reforming of methane at 1-10 atm and 850 ^{o}C. The tri-reforming of methane has been conducted in our laboratory to benefit from the synergistic combination of steam reforming, CO_2 reforming, and partial oxidation of methane in a kg-lab packed bed reactor and evaluating this process at conditions close to those used at industrial scale for the production of syngas. Characterization techniques, such as TGA SEM and TEM, were employed, and their results have been combined to explain the effects of catalyst synthesis methodology on the reaction performances. The wet impregnation method consistently showed more resistance to coke formation due to its better ability to load Mg, Ni and Si. It significantly impacted the activity in the presence of H_2O and O_2 contents in the feed. In comparison to other reforming processes, both experimental and thermodynamic studies confirmed that the tri-reforming at 1-10 atm and 850 ^{o}C produced the desired H_2/CO ratio with minimum coke deposition, slowed down the catalyst deactivation, and showed a higher reactant conversion over longer time-on-stream.

Keywords

mining residue, Ni-UGSO pellet, Tri-reforming of methane, pellet formation, thermodynamic data.