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Plasma assisted Chemical Looping reactions using nano-catalysts for co-production of syngas and hydrogen

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We present the results of non-equilibrium plasma enhanced Chemical Looping (CL) reduction/oxidation steps with water splitting oxidation step and CH4+CO2 reforming step, respectively. Syngas and C2 hydrocarbons are produced during the reduction step and hydrogen is yielded during the oxidation step. Combinations of nano-catalyst and Oxygen Carrier (OC) materials such as Ni-based perovskite with ceria and Ru-CeO2-NR (nano-rod) are used to improve the performance at lower temperatures along with the plasma. Experiments show production of hydrogen and syngas at low temperatures (150-400 ℃) while no reactions are observed with catalyst alone for testing temperatures below 750 ℃. Optical Emission Spectroscopy of the heterogeneous reactions will be presented. The experiments were conducted in the temperature range 150-400 ℃ under atmospheric pressure. Temporal optical emission of various species such as CO2, CH, CO, OH, and C2 based species are collected over the wavelength range of 300 to 600 nm and analyzed for understanding the heterogeneous reaction mechanisms.

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