Novel Solar-Assisted Method for Mitigation of Methane Emissions via a New Highly Efficient Catalyst

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Global warming poses a pressing challenge marked by rising temperatures and environmental impacts. Methane (CH4) and carbon dioxide (CO2) are the main drivers of this phenomenon due to their damage and widespread emissions. Methane, with 80 times more warming potential than CO2, exacerbates the issue. The current methods of methane mitigation and H2 production worsen the problem by converting CH4 to CO2, adding +500Mt of CO2 annually. Underscoring the urgent need for technological expansion to mitigate CH4 & CO2 emissions. This study introduces an innovative solar-assisted system targeting the most abundant greenhouse gases, CH4 & CO2, directly from point sources, converting them into valuable products: H2 & CO (syngas). By integrating a novel trimetallic catalyst Ni-Cu-Co/Mg(Al)O into a modified solar reactor, operating at 400-600°C, reducing reliance on external non-renewable energy sources and offering an eco-friendly solution. Characterization of the synthesized catalyst using XRD, BET, TEM, and EDX techniques reveals promising features: higher surface area, small particle size (4-7nm), and uniform active site distribution. Performance evaluation through dry reforming of methane tests under CH4 source conditions demonstrates remarkable efficiencies of 75%, and 90% in CH4 & CO2 conversions at 700°C, and 800°C, respectively, with excellent stability, showcasing the success of solar-assisted CH4 and CO2 reduction. Furthermore, the system yields impressive H2 rates of 72%, and 86%, holding significant promise for applications such as coal mines, landfills, and industrial syngas production. This approach not only reduces pollution but also promotes efficient H2 production, aligning with the United Nations' goal of limiting global temperature for a more sustainable planet

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