Extended Abstract | Bioenergy and Bioresource:Open Access | 2020
Vol.1 No.8

Photoassisted methanation using CuO2 nanoparticles supported on graphene as photocatalyst

Diego Mateo, Josep Albero and Hermenegildo García

Photoassited CO2 methanation can be carried out efficiently at 250 oC using Cu2O nanoparticles supported on few layer graphene (Cu2O/G) as photocatalyst. The Cu2O/G photocatalyst has been prepared by chemical reduction of a Cu salt (Cu(NO3)2) with ethylene glycol in the presence of defective graphene obtained from the pyrolysis of alginate acid at 900 oC under Ar flow. Using this photocatalyst a maximum specific CH4 formation rate of 14.93 mmol/gCu2O·h and apparent quantum yield of 7.84 % was achieved, which is one of the highest reported values for the gas-phse methanation reaction at temperatures below Sabatier reaction (> 350 oC). It was found that the most probable reaction mechanism involves photoinduced electron transfer from the Cu2O/G photocatalyst to CO2, while evidence indicates that light-induced local temperature increase and H2 activation are negligible. The role of the temperature in the process has been studied, the available data suggesting that heating is needed to desorb the H2O formed as product during the methanation. The most probable reaction mechanism seems to follow dissociative pathway involving detachment of oxygen atoms from CO2.

CO2 discharges could be decreased.1, 2, 3 Considering that CO2 hydrogenations are among the couple of thermodynamically downhill responses having CO2 as a reagent, numerous examinations have zeroed in on this reaction.4, 5, 6 Due to slow energy, hydrogenation of CO2 can be done chemically at temperatures above 250°C and, contingent upon the impetus, even at higher temperatures, normally about 550°C. Something else, the response pace of CO2 hydrogenation would be unacceptably low.7, 8, 9 However, performing synergist responses at high temperatures requires the utilization of energy. In such manner, ongoing methodologies that are pulling in much interest comprise of creating electrochemical CO2 decrease in gas stage and fluid media utilizing the sustainable power when delivered in abundance, just as photoassisted adaptations of CO2 hydrogenation, utilizing sunlight based light as an illumination source10, 11, 12, 13, 14, 15, 16, 17 It has been discovered that photoassisted CO2 hydrogenation can be completed at much lower temperatures than traditional synergist responses. At those low temperatures, the warm cycle either doesn't happen at all or contributes in a minor extent to the CO2 conversion.11, 18, 19, 20 As to of photoassisted CO2 hydrogenation, it has been accounted for that Ru nanoparticles (NPs) kept on silicon nanowires are a photothermal impetus to create CO2 methanation, arriving at a transformation pace of around 1 mmol/g·h at 150°C.21 Under these conditions, responses did without brightening demonstrated warm change of about 0.51 mmol/g·h.21 Mechanistic investigations have proposed that on account of Ru NPs on silicon nanowires, the response includes light assimilation by a restricted bandgap silicon semiconductor that, upon charge recombination, moves the warmth locally at the nanoscale to the Ru NPs, giving adequate energy to catalyze the reaction.22 Continuing with this line of examination, it is imperative to grow more proficient photocatalytic frameworks ready to initiate the photothermal CO2 hydrogenation at higher rates.

This work is partly presented at Joint Event 7th World Congress and Expo on Green Energy June 24-25, 2019 Barcelona, Spain