Photocatalytic oxidation of methane coupling with hydrogen evolution from water over Au decorated Ga2O3 catalysts

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Abstract

Methane is a major constituent of natural gases and is an important source of carbon and hydrogen for the chemical industry. However, CH4 is one of the most stable molecule and high reaction temperatures are required to transform CH4 into more valuable chemicals [1]. In this work, we investigated the use of β-Ga2O3 loaded with Au nanoparticles (0.1–1.0%) as photocatalysts that were prepared 3 different methods: pre-formed NNTS; in-situ; and H2 reduction. The materials were characterized by XRD, UV-Vis, TEM, and Raman. The reactions were performed on a photocatalytic reactor with Hg lamp (450W, UV/A/B/C). CH4 gas was bubbled into H2O, Au/Ga2O3 in suspension and the products were identified by GC-MS and quantified by GC-FID/TCD using calibration curves. C2H6, CO2, H2 with minor quantities of C2H4, C3H8, C4H10, and CO were produced. The best performance was observed for the photocatalyst prepared with 0.03% of Au that produced 112 □mol.gcat-1h-1 of C2H6 and 16.500 □mol.gcat-1h-1 of H2.

Keywords

Photocatalysis; methane; photocatalysts; gold nanoparticles; hydrocarbons;

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References

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