Au/ (B OR C) DOPED g-C_3N_4/ TiO_2 NANOCOMPOSITES FOR PHOTOREDUCTION OF CO_2 WITH WATER IN THE GAZ PHASE INTO CH_4

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ABSTRACT:

Photocatalytic CO_2 reduction with water in the gas phase (artificial photosynthesis) into methane is one of the most useful routes to recycle CO_2. Among of the possible semiconductor (SC) photocatalysts, g-C_3N_4 and TiO_2 are interesting due to their abundance, low cost, chemical and thermal stability, and non-toxicity. The limited solar absorption and high recombination rate of photogenerated charge carriers of these materials however severely impede their applications. Several strategies have been considered to overcome these limitations such as SC doping, heterojunction formation and co-catalyst addition. We have recently shown that an efficient heterojunction between C_3N_4 and TiO_2 could be engineered by polycondensing C_3N_4 precursors impregnated on pre-formed TiO_2 nanocrystallites acting as hard templates [1]. This method yields few layer C_3N_4 films in strong interaction with TiO_2, which give highly efficient Au/C_3N_4-TiO_2 photocatalysts for water splitting [1]. However, these composites did not allow us to get CH_4 in the photoreduction of CO_2 with H_2O in the gas phase using visible illumination.

Here we show that an efficient heterojunction with enhanced absorption properties can be constructed for CO_2 photoreduction with H_2O under visible light by a modified polycondensation method, using urea as C_3N_4 precursor together with boric or citric acid [2,3] which will dope the C_3N_4 structure. The nanocomposites Au/B-g-C_3N_4/TiO_2 and Au/C-g-C_3N_4/TiO_2 showed average CH_4 production rates (fig.1) during 10h (8 and 34 times higher, respectively, than those obtained on Au/TiO_2 or Au/g-C_3N_4/TiO_2).

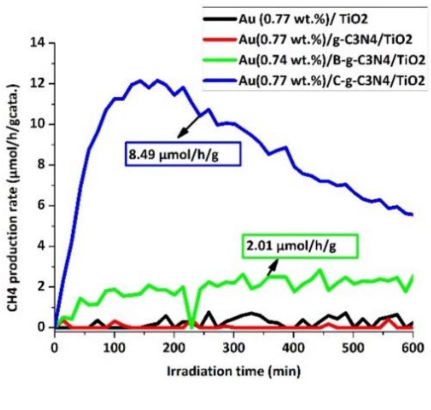

Figure 1: Average CH_4 production rate (during 10 h) for Au/TiO_2, Au/g-C_3N_4/TiO_2 and Au/(B or C) doped g-C_3N_4/TiO_2.

References

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