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Photocatalytic hydrogen production from aqueous methanol solution over metallized TiO_2

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Abstract: In this paper, photocatalytic hydrogen production from aqueous methanol solution with metallized titanium dioxide by platinum and gold is reported. Scherer equation was used to calculate of mean crystallite sizes of bare and metallized TiO_2 via XRD data. The calculated mean crystallite sizes of bare TiO_2 are decreased on metallized it. The AFM images indicate that the shape of bare and metallized TiO_2 is spherical. The particle size was found to be ranging between 9 and 11 crystallite size. The band gap energy for bare TiO_2, Pt(0.5%)/TiO_2 and Au(0.5%)/TiO_2 were calculated after applying the Kubelka-Munk transformation. The results show that there is a shifting from ultra-violet absorption to visible light absorption (red shift) and as a consequence a narrowing in band gap in was observed. The band gap of bare TiO_2 was reduced from 3.289 eV to 3.263eV for Pt(0.5%)/TiO_2 and to 3.246eV for Au(0.5%)/TiO_2. Photoirradiation of argon purged aqueous methanol solution gave hydrogen in the presence of platinum and gold-loaded nanosized titanium dioxide (Hombikat UV 100). The photocatalytic activity of dehydrogenation of aqueous methanol solution of bear and metallized TiO_2 was in the order Pt(0.5%)/TiO_2>Au(0.5%)/TiO_2 while no H_2 evolved when using a bare TiO_2. These results depended significantly on the work function values of Pt (5.93 eV) and for Au (5.31 eV).
Keywords: Hydrogen production; Photocatalytic activity; Pt/TiO_2; Au/TiO_2; Nanoparticle; Methanol.

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