Nanocomposites and nanomaterials

Photocatalytic properties of layered nanostructures $K_3H_3Nb_{10.8}O_{30}$ in the hydrogen evolution reaction in aqueous solutions of alcohols

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The paper investigates photocatalytic properties of layered nanostructures $K_3H_3Nb_{10.8}O_{30}$, in the reaction of photocatalytic hydrogen production from aqueous solutions of electron-donor substrates. It establishes that the treatment of potassium niobate with nitric acid leads to changing of the phase composition, and to increasing photocatalytic activity in the process of hydrogen production. The maximum rate of H_2 formation in these systems is achieved after treatment of KNb_3O_8 with nitric acid within 10 hours, which corresponds to a complete transformation of the initial niobate in $K_3H_3Nb_{10.8}O_{30}$ [1]. The article shows that activity layered nanostructures of $K_3H_3Nb_{10.8}O_{30}$ have more than an order higher activity in the process of hydrogen production compared with the KNb_3O_8. The paper investigates influence of a number of factors on the efficiency of hydrogen production in order to determine optimal conditions for the process. In particular, it establishes that the rate of hydrogen production depends on the nature of the electron-donor substrate and increases in that order : isopropanol ethanol methanol. The highest speed of photocatalytic hydrogen production observed with methanol can be associated with the small size of its molecules, which allows them to get into the interlayer space of the niobate and effectively catch photogenerated holes, and thus decreasing electron-hole recombination. An additional explanation of the obtained sequence may serve a symbatical series of photocatalytic activity, acidity increase of the investigated alcohols. The paper determines that the rate of the photocatalytic hydrogen evolutionon reaction depends on the amount of methanol in the reactive blend as a dome-shaped curve with the maximum of 50 percent. In this case, the activity of $K_3H_3Nb_{10.8}O_{30}$ is high even when the content of CH_3OH is about 20%, which allows using dilute solutions of electron donor substrates to produce hydrogen.

1. *Shvalagin V., Grodzyuk G.* Photocatalytic Activity of Layered KNb_3O_8 and $K_3H_3Nb_{10.8}O_{30}$ in a Gas-Phase Decomposition of Methanol // Theor Exp Chem.-2017.-**52**, N 6.-P. 337-341.