Valérie Keller, J Nanomed Nanotechnol 2015, 6:4
http://dx.doi.org/10.4172/2157-7439.S1.021

OMICS International
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Nanotechnology Congress & Expo

August 11-13, 2015 Frankfurt, Germany

Synthesis and reactivity of Au/g-C_3N_4/TiO_2 nanocomposites for water-splitting and H_2 production under solar light illumination

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Nowadays, the major challenge is to find new environmentally friendly ways to produce energy that may cover the global consumption. The direct conversion of solar energy though an energy carrier (fuel), storable and usable upon request, appears as an interesting alternative. Photocatalysis is an innovative and promising way to produce pure hydrogen from renewable energy sources. Indeed, the water dissociation (water-splitting) highlighted by Fujishima and Honda in a photoelectrocatalytic cell opened a promising way to produce hydrogen from light energy. In our study, we will focus on a photocatalytic TiO_2-based system associated with graphitic carbon nitride (g-C_3N_4). With a band gap of 2.7 eV, g-C_3N_4 allows the valorization of an important part of the visible light spectra in the context of water splitting. TiO_2 powder is obtained via a "sol-gel" process and g-C_3N_4 was obtained via a thermal polycondensation reaction of specific nitrogen-containing precursors. g-C_3N_4/TiO_2 nanocomposites were obtained either (i) by introducing g-C_3N_4 (as synthesized) during the sol-gel synthesis of TiO_2 or (ii) by introducing TiO_2 (as synthetized) during the g-C_3N_4 synthesis. Gold nanoparticles were synthesized - directly onto the TiO_2, the g-C_3N_4 and the g-C_3N_4/TiO_2 support – by chemical reduction of the $HAuCl_4$ precursor in an excess of $NaBH_4$. The synthesis of new nanostructured composites allowed us to achieve better hydrogen production yield than the reference Au/TiO_2 and Au/g-C_3N_4 samples. Future goals are to find the optimal amount of Au on the Au/g-C_3N_4/TiO_2 composites but also the optimal amount of g-C_3N_4.

Biography

Valérie Keller is a Senior Scientist at ICPEES (Institute of Chemistry and Processes for Energy, Environment and Health) in Strasbourg. She received her PhD degree in Chemistry and Catalysis from the University Louis Pasteur of Strasbourg in 1993. In 1996 she returned to Strasbourg and was appointed as Researcher in CNRS, where she is now responsible of the Team "Photocatalysis and Photoconversion". In 2012 she was promoted as Director of Research. Her main research activities concern photocatalysis for environmental, energy and health applications, and the synthesis and characterization of nanomaterials for photoconversion purposes. She is the author of over 95 publications in peer-reviewed journals and more than 50 oral communications in international conferences and symposium. She is also the author of 15 patents.

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