

# Interest of Gas Phase Processes for the Synthesis of Materials Activated under Light: Example in Photocatalysis and Photovoltaics

N Herlin Boime, S Ngo, S. Bouhadoun, R Belchi, A Habert, F Dapozze, J  
Bouclé, C Guillard

► **To cite this version:**

N Herlin Boime, S Ngo, S. Bouhadoun, R Belchi, A Habert, et al.. Interest of Gas Phase Processes for the Synthesis of Materials Activated under Light: Example in Photocatalysis and Photovoltaics. SPASEC22, Nov 2017, Clearwater Beach, United States. cea-02341307

**HAL Id: cea-02341307**

**<https://hal-cea.archives-ouvertes.fr/cea-02341307>**

Submitted on 31 Oct 2019

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

## Interest of Gas Phase Processes for the Synthesis of Materials Activated under Light: Example in Photocatalysis and Photovoltaic

N. Herlin Boime<sup>1</sup>, S. Ngo<sup>2</sup>, S. Bouhadoun<sup>1,2</sup>, R. Belchi<sup>1,3</sup>, A. Habert<sup>1</sup>, F. Dapozze<sup>2</sup>, J. Bouclé<sup>3</sup>, C. Guillard<sup>2</sup>

1, NIMBE, CEA, CNRS, Université Paris-Saclay, CEA Saclay 91191 Gif-sur-Yvette France

2, IRCELYON, CNRS-Université Claude Bernard Lyon 1, 2 av. Albert Einstein, 69626 Villeurbanne Cedex, France

3, Univ. Limoges, CNRS, XLIM, UMR 7252, F-87000 Limoges, France

Due to its high activity under near UV illumination, one of the most studied materials in photocatalytic as well as in photovoltaic studies is titanium dioxide  $\text{TiO}_2$  especially in its anatase crystalline form. In both cases, one of the phenomena limiting the efficiency is the recombination of electron-holes pair. In this context, the use of composites based on  $\text{TiO}_2$  nanoparticles and carbon or metallic nano-objects is a relevant strategy towards more efficient electron transfer processes.

This paper will present the one-step synthesis of such nanocomposites and some studies on their photocatalytic or photovoltaic applications. To achieve the synthesis of high quality nanocomposites presenting well-controlled physical properties, we use the laser pyrolysis method. This method is based on the interaction between a high power  $\text{CO}_2$  laser and a gaseous or liquid precursor. In all cases Titanium tetraisopropoxide (TTIP) was used as the  $\text{TiO}_2$  precursor. Hydrogen tetrachloroaurate was dissolved in the TTIP solution to produce Au loaded  $\text{TiO}_2$  nanoparticles (Figure 1, left). The efficiency of these nanoparticles was studied under air and  $\text{N}_2$  for the photocatalytic decomposition of acetic acid. Graphene nanoparticles were dispersed in liquid TTIP to produce composite nanoparticles where  $\text{TiO}_2$  is grown at the surface of the graphene layers (Figure 1, right). These composite nanoparticles were used to form the porous layer of a perovskite solar cell. In both cases, a significant effect is observed by comparison to the performances obtained from pure  $\text{TiO}_2$ .

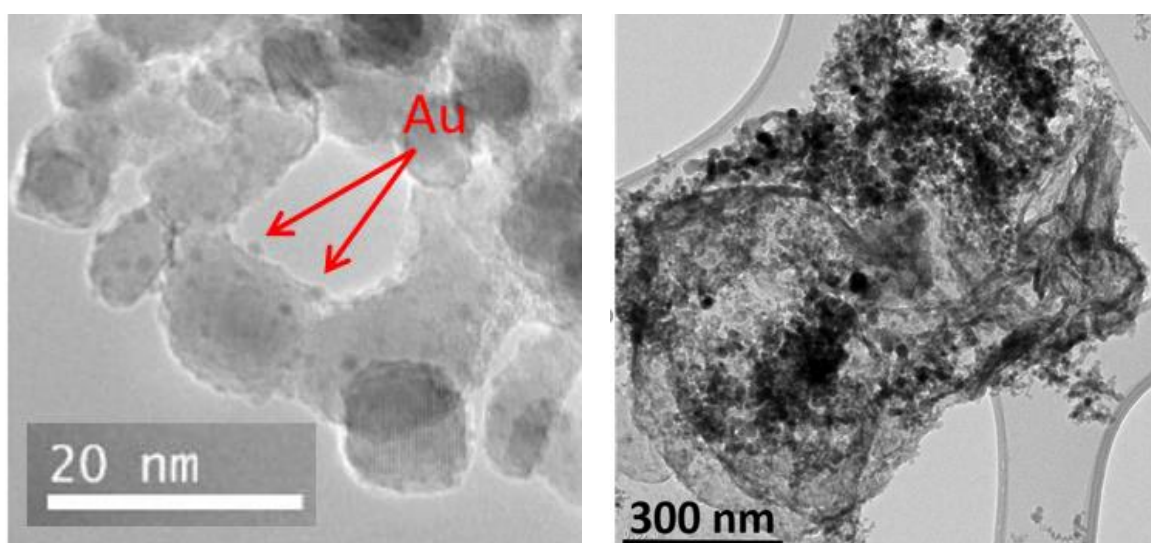


Figure 1 : TEM images of (left) Au loaded  $\text{TiO}_2$  nanoparticles (right)  $\text{TiO}_2$  nanoparticles at the surface of a graphene layer.