Synthesis of TiO_2/Au and TiO_2/Pt by Reverse Phase Separation

Gabriel A. Pérez-Acosta, Leonardo Pacheco-Londoño, and Samuel P. Hernández-Rivera

ALERT DHS-Center of Excellence

Center for Chemical Sensors Development, Department of Chemistry. University of Puerto Rico-Mayagüez

Introduction

TiO_2/metal nanomaterials has become an important research subject because of their wide band gap and higher catalytic activity which find applications in photocatalysis, electrocatalysis, photoelectrochemical solar cells, photoelectrocatalysis and sensors.

State of the Art

Composite of TiO_2 with metal had been synthesized by several groups and a number of papers were published on the topic. The synthetic method used was in a water matrix but reverse phase was not used. Nanoparticles from water matrix are difficult re-suspend in other more volatile solvents. It is possible have nanoparticles easier to resuspend from reverse phase synthesis.

Challenges and Technology Transfer

Catalytic properties of ultrasmall gold nanoparticles has generated a significant understanding of the properties in photocatalytic reactions. If capped with organic molecule, TiO_2 exhibits unusual redox activity by accepting electron from suitable donor or electrode. This and many other properties highlights the importance of nanostructures assemblies to model the energetic photocatalysts. Exploring these composites will direct future research toward utilization of less noble metals as a catalysts for fuel production.

Methodology

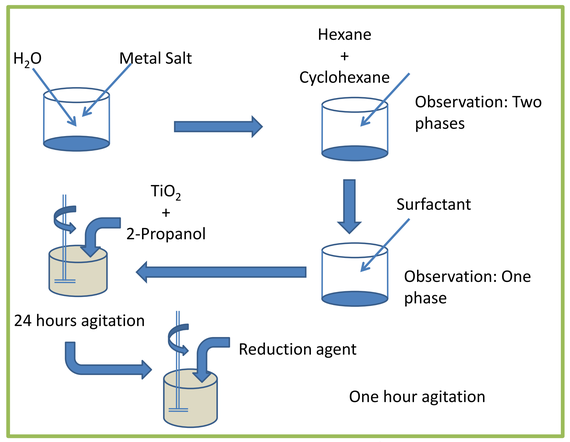


Figure 1: Experimental procedure for TiO_2/metal nanoparticles.

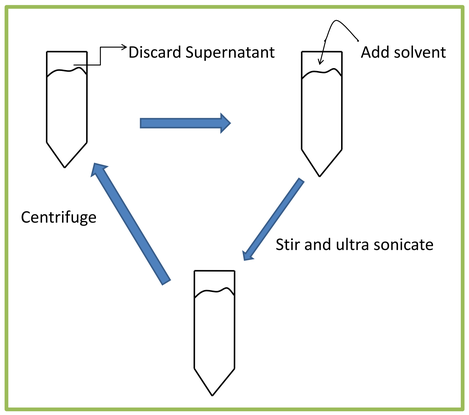


Figure 2: TiO_2/metal separation process.

Solvents used are:
1) hexane
2) acetone
3) 2-propanol
4) water

Raman

A Raman Renishaw RM2000 was used to analyze all samples. Small sample in solid phase. Parameters for the samples were: 3 accumulations and range of 100 and 2000 cm^{-1}.

IR

A Bruker Optics IFS 66v/S spectrometer

TGA

A thermal gravimetric analyzer Q-500 (TA Instruments, USA) was used for bulk measurements. A constant nitrogen flow was used for all sample runs. Standard platinum sample holders were used. Aluminum pans on top of the platinum holder were contained the samples at a specific area.

UV

UV-VIS Varian spectrophotometer

Results

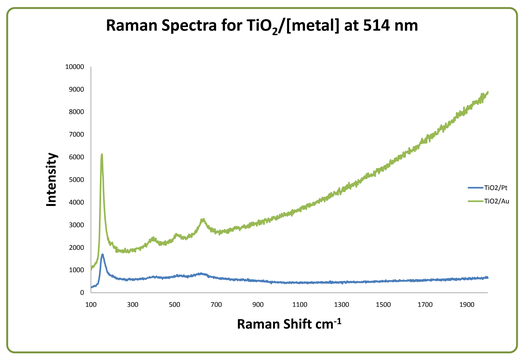
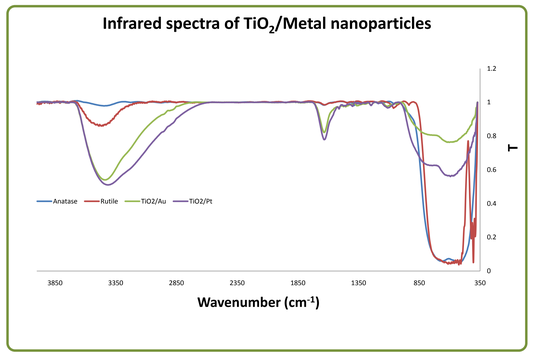


Figure 3.



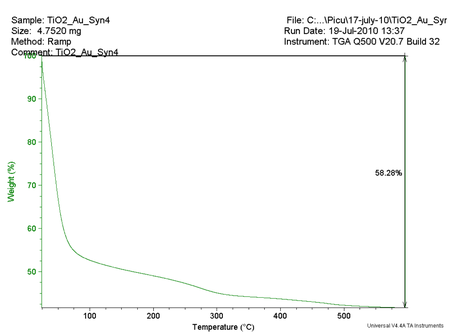
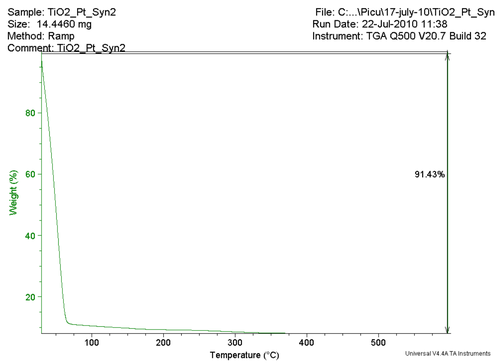
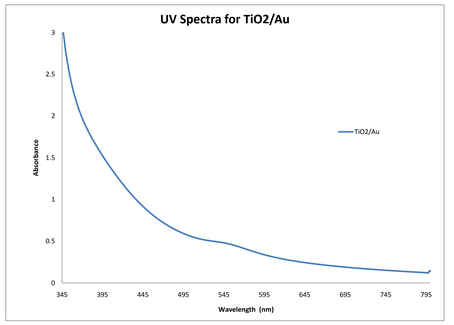
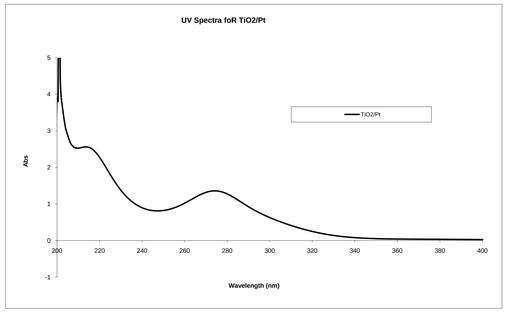


Figure 4.







Conclusion

The band gap of TiO2 was modified. The metal is not included in the crystalline structure but rather a homogeneous mixture of TiO_2 and metal was obtained. Nanoparticle were formed for high re-suspension in ethanol.

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