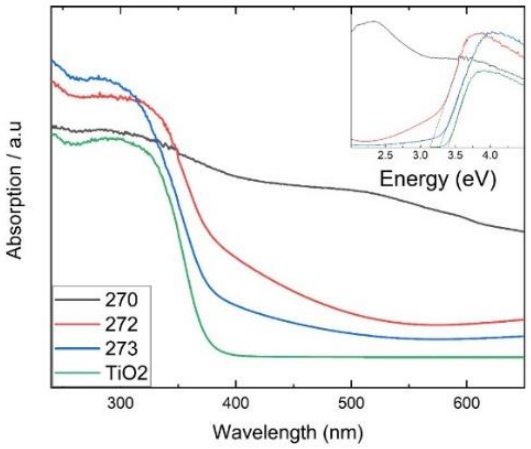
Synthesis and Characterization of Cu_2S – TiO_2 Heterostructures with Enhanced Photophysical Properties.

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Abstract

As environmental damage continues to increase with time, research must be conducted with environmental applications in mind. TiO_2 has been extensively studied for photocatalysis due to its feasible synthesis as well as its chemical and thermal stability. A main drawback of TiO_2 is its large bandgap, which leads to its poor photocatalytic activity in visible light. This can be overcome by using TiO_2 in conjunction with low bandgap semiconductors. Recent studies proved that doping TiO_2 with copper-based material has shown to display better photocatalytic activity in visible light than pure TiO_2[1,2]. In this study, we synthesized Cu_2S@TiO_2 nano-heterostructures of different copper ratios utilizing the sonochemical method. The composites were characterized using numerous techniques. The use of the Scanning Electron Microscope showed the preservation of the structural integrity of the TiO_2. Powder X-Ray Diffraction and Raman Spectra confirmed the presence of both materials and their crystalline nature. UV-Vis proved the capability of Cu_2S to enhance the light absorption of Cu_2S@TiO_2 towards the visible region with a decrease in the bandgap up to 3.1eV. Previous research has shown the application of TiO_2 for water splitting and chemical degradation via photocatalysis[3,4]. Sulfur doped copper nanoparticles exhibited promising applications towards a selective reduction of CO_2 to formate[5,6]. Thus, the newly developed Cu_2S@TiO_2 nanocomposite has great promise of application for water splitting and CO_2 reduction. Consequently, helping the cause of decreasing environmental damage.



UV-Vis spectra of unmodified TiO_2, Cu_2S (270), and Cu2S@TiO2 (272,273) with varying ratios of Cu2S and TiO2.

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Biography

Dr. Mahmoud Abdelnaby has experience and skill in reticular chemistry, nanotechnology, and organic chemistry. His efforts in these fields contribute to the fight against climate change. Abdelnaby currently works as a post-doc fellow under the Yaghi Group at KFUPM's Center of Excellence in Nanotechnology. He completed his B.S.with honors in Chemistry, Faculty of Science, Cairo University, Egypt (2008). He earned his M. Phil in organic chemistry from the Faculty of Science, Cairo University, Egypt (2013).

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