



Tsinghua University
Department of Physics

Physics Colloquium

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Fall

Black Titanium Dioxide: A New Engineered Nanoparticle for photocatalysis

Abstract

TiO₂ is almost an ideal photocatalyst in that it is stable and relatively inexpensive. Unfortunately its large band gap ($>3.0\text{eV}$) makes it inefficient for photocatalysis with solar radiation. As a result there have been many attempts to reduce the band gap of TiO₂ by doping with impurities. These attempts have reduced the band gap to the visible at most. Recently a breakthrough has been achieved which succeeded in converting white TiO₂ nanocrystals into a black TiO₂ powder with an absorption edge reduced to 1.2 eV. [Xiaobo Chen, Lei Liu, Peter Y. Yu, and Samuel S. Mao. Increasing Solar Absorption for Photocatalysis with Black Hydrogenated Titanium Dioxide Nanocrystals. Science 331, 746 (2011).] This black TiO₂ powder has demonstrated enhanced efficiency in photocatalysis under solar irradiation. High resolution transmission electron microscopy has shown that the black TiO₂ nanoparticles consist of an anatase core surrounded by a disordered shell. Since the appearance of these pioneering results, black TiO₂ in other forms such as nanowires have also been fabricated. However, the exact nature of the disordered shell in black TiO₂ remains unknown. In this talk I shall present recent experimental and theoretical results which shed light on the structural, chemical and electronic properties of black TiO₂ powder.

Speaker

Peter Yu received his B.S. from the University of Hong Kong in 1967 and the Ph.D. in Physics from Brown in 1972. After doing postdoctoral work at Berkeley between 1971-73, he joined the IBM T. J. Watson Research Center as a research staff member. He returned to Berkeley as a faculty member in 1979. He is a fellow of the American Physical Society and has been a Guggenheim Fellow and Miller Professor.



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Zheng Yu-Tong Lecture Hall, New Science Building

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<http://www.phys.tsinghua.edu.cn/Colloquium/>