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RESEARCH FRONT: Nanomaterials

Foreword

ICONN 2006 Research Highlights

Paul Mulvaney

Aust. J. Chem. **2007**, *60*, 445–446.

Nanoscience and nanotechnology are likely to impact our lives in many ways over the next few decades. This issue's Research Front contains highlights from the Nanomaterials Symposium at ICONN 2006, including topics such as metal particles, semiconductor nanocrystals, and carbon nanotubes.

Reviews

Optical Effects of Metallic Nanoparticles

Christian Dahmen, Gero von Plessen

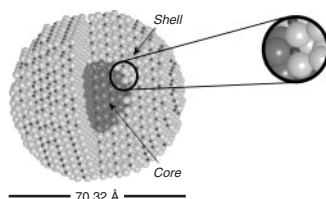
Aust. J. Chem. **2007**, *60*, 447–456.

Metallic nanoparticles show a rich optical behaviour. Research into their optical effects, a field with a long tradition, has seen recent rapid development because of progress in nanoparticle fabrication, spectroscopic techniques, and computational methods. This article provides a survey of the optical effects of metallic nanoparticles, and covers both fundamental phenomena and emerging applications.

Review of the Synthetic Chemistry Involved in the Production of Core/Shell Semiconductor Nanocrystals

Joel van Embden, Jacek Jasieniak, Daniel E. Gómez, Paul Mulvaney, Michael Giersig

Aust. J. Chem. **2007**, *60*, 457–471.

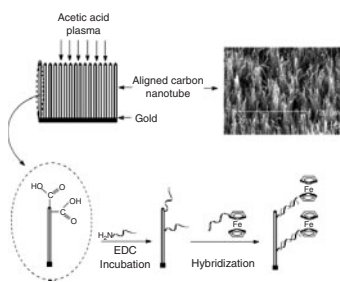


Control of the production of core/shell semiconductor nanocrystals with well-defined dimensionalities is critical to tailor their application and to provide accurate insights into their complex properties. With a focus on CdSe core/shell particles the methodologies of, factors that effect the control of, and significant breakthroughs and recent advances involved in the production of core/shell nanocrystals are presented.

Electrochemical Sensors Based on Architectural Diversity of the π -Conjugated Structure: Recent Advancements from Conducting Polymers and Carbon Nanotubes

Liming Dai

Aust. J. Chem. **2007**, *60*, 472–483.

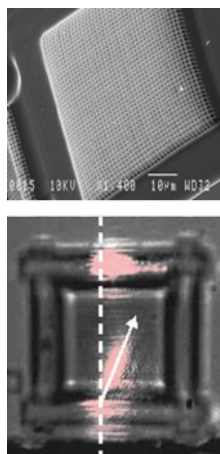


Conjugated conducting polymers and carbon nanotubes are two important components for creating electrochemical-sensing materials. The combination of carbon nanotubes with conducting polymers or other functional materials (e.g. DNA chains, proteins, metal nanoparticles, carbon fibres) creates synergetic effects that provide the basis for numerous novel sensors that feature high sensitivity, good selectivity, excellent environmental stability, and low power consumption. This article reviews recent developments in this exciting new area of electrochemical sensing.

Two-Photon Polymerization for Three-Dimensional Photonic Devices in Polymers and Nanocomposites

Baohua Jia, Jiafang Li, Min Gu

Aust. J. Chem. **2007**, 60, 484–495.

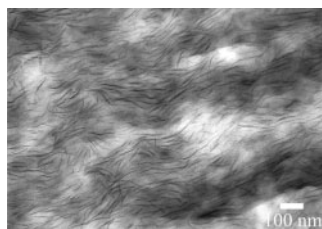


Two-photon polymerization is an important and useful technique in the fabrication of next-generation three-dimensional miniaturized photonic devices. In this article the recent advances in this field are reviewed with an emphasis on both material preparation and device formation, in particular the fabrication of functional active devices. The rapid development in this interdisciplinary area will greatly advance the knowledge in chemistry, nanotechnology, and telecommunications.

Toughening, Thermal Stability, Flame Retardancy, and Scratch–Wear Resistance of Polymer–Clay Nanocomposites

Aravind Dasari, Szu-Hui Lim, Zhong-Zhen Yu, Yiu-Wing Mai

Aust. J. Chem. **2007**, 60, 496–518.



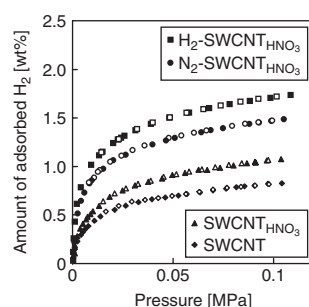
The addition of nanoclay to polymers enhances their physical and mechanical properties. However, some problems remain with the resultant nanocomposites, which include concerns about thermal stability, flame retardancy, fracture toughness, and scratch–wear resistance. It is the inadequacy of these specified properties that has curtailed potential applications of this class of new materials. In this Review, these issues are examined in detail and the approaches that have been used to resolve them are critically assessed.

Rapid Communications

Effects of Nitric Acid and Heat Treatment on Hydrogen Adsorption of Single-Walled Carbon Nanotubes

H. Takagi, Y. Soneda, H. Hatori, Z. H. Zhu, G. Q. Lu

Aust. J. Chem. **2007**, 60, 519–523.

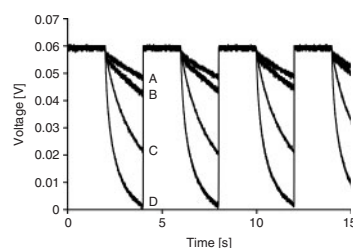


Nitric acid treatment enhanced hydrogen adsorption on single-walled carbon nanotubes at ambient temperature by opening nanotubes and changing the bundle structure. Heat treatment of the acid-treated nanotubes further increased hydrogen adsorption by removing functional groups introduced by acid treatment. Hydrogen flow was more effective than nitrogen flow for removing functional groups.

Mesoporous Gold Sponge

Michael B. Cortie, Abbas I. Maaroof, Nicholas Stokes, Alessia Mortari

Aust. J. Chem. **2007**, 60, 524–527.

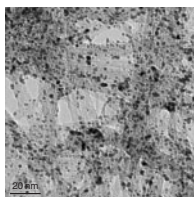


Gold sponge with nanoscale pores was prepared by alkaline leach of Al from AuAl₂. A bimodal pore distribution is obtained by phase separation or application of an RF bias during deposition. The sponge has electrochemical applications including biosensors, high efficiency ultracapacitor electrodes, semi-transparent current collectors in dye sensitized photovoltaic cells, or lithium storage electrodes.

Carbon Nanotube Free-Standing Membrane of Pt/SWNTs as Catalyst Layer in Hydrogen Fuel Cells

Jason M. Tang, Kurt Jensen,
Wenzhen Li, Mahesh Waje,
Paul Larsen, Palanisamy Ramesh,
Mikhail E. Itkis, Yushan Yan,
Robert C. Haddon

Aust. J. Chem. **2007**, *60*, 528–532.



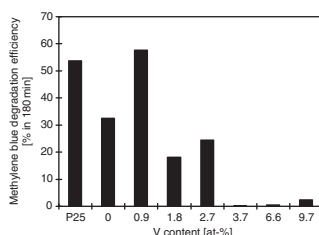
A major obstacle to the commercialization of fuel cells is the prohibitive cost and limited supply of the precious platinum group metals usually used as the catalyst. Here, SWNTs are used as a catalyst support and perform better than XC-72 carbon black in the absence of Nafion in the catalyst layer structure.

Full Papers

Porous Vanadium/Titanium Oxides—Synthesis, Characterization, and Photocatalytic Activity

Meifang Zhou, Fuzhi Huang,
Xingdong Wang, Johan du Plessis,
Anthony B. Murphy,
Rachel A. Caruso

Aust. J. Chem. **2007**, *60*, 533–540.

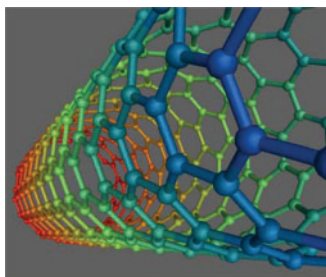


Improving the photoactivity of titanium dioxide will enhance the materials application in environmental remediation. Here, the influence of both structural control using an agarose template and compositional variation with vanadium doping on the final morphological properties and efficiency of photodegradation of methylene blue was studied. The sample containing 0.9 at-% vanadium gave the best photocatalytic results under either UV or visible light illumination.

On the Development of Fluidized Bed Chemical Vapour Deposition for Large-Scale Carbon Nanotube Synthesis: Influence of Synthesis Temperature

Chee Howe See, Andrew T. Harris

Aust. J. Chem. **2007**, *60*, 541–546.



The potential applications of carbon nanotubes (CNTs) continue to increase, yet the absence of large-scale CNT synthesis technology is limiting their research and development. Here, fluidized bed chemical vapour deposition is demonstrated to be the most promising technology for large-scale, low-cost, CNT synthesis, by the production of CNTs on alumina-supported Fe, Co, or Ni catalysts in a 0.5 kg h⁻¹ FBCVD reactor, using ethylene as a carbon source.

Corrigendum

Oxidation of Aromatic Alkynes with Nitrate Radicals (NO₃[•]): An Experimental and Computational Study on a Synthetically Highly Versatile Radical (appearing in *Aust. J. Chem.* **2007**, *60*, 420–428)

Uta Wille, Jilliarne Andropof

Aust. J. Chem. **2007**, *60*, 547.