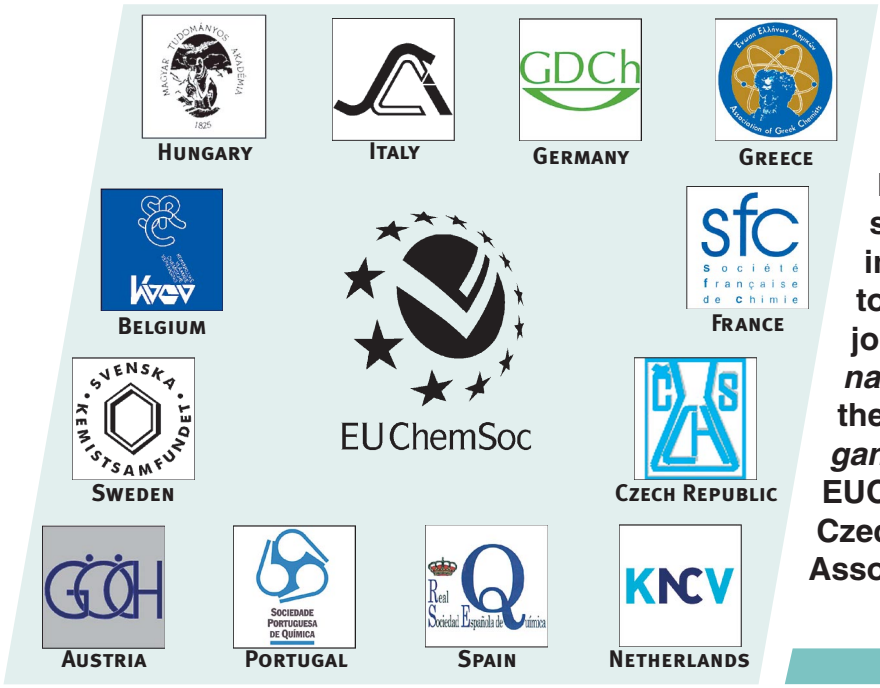
EurJIC
European Journal of Inorganic Chemistry



The EUChemSoc Societies have taken the significant step into the future by merging their traditional journals, to form two leading chemistry journals, the *European Journal of Inorganic Chemistry* and the *European Journal of Organic Chemistry.* Three further EUChemSoc Societies (Austria, Czech Republic and Sweden) are Associates of the two journals.

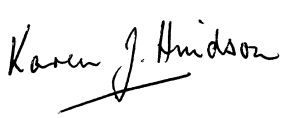
SPECIAL ISSUE

Problem-Solving with Inorganic Chemistry

Karen Hindson
Editor, *EurJIC*

Chemistry has always been an innovative discipline. The curiosity of chemists addresses questions as diverse as life itself – from how to suppress pain, to fight against disease and to master the challenges accompanying an aging population through the creative demands of fashion, sport and convenience products, the humdrum requirements of cleaning in the household and in industry, fuels for transport and other developments in everyday pursuits, to the problems of securing sufficient food for a growing population and the creation of materials for miniaturization in a computerized world.

In recent years the challenges of pollution and climate change have given Inorganic Chemistry an additional impetus to synthesise and tune the properties of materials that can, for instance, sense harmful chemicals, catalyse the decomposition of toxic substances, or provide cleaner energy, to name but a few. *EurJIC* is pleased to bring you a peek into the exciting developments in one area of this research: metal oxide nanoparticles. The guest editors of this special issue, Nicola Pinna and Markus Niederberger, explain their concept for the issue in their editorial. I would like to thank them for the generous gift of their time in preparing this insight into the advances in the field and hope that the issue will not only be a catalyst for the ideas of those who work on these topics but also provide an interesting read for all who are interested in the potential solutions to the problems our world faces.



Dr. Karen Hindson
Editor, *EurJIC*

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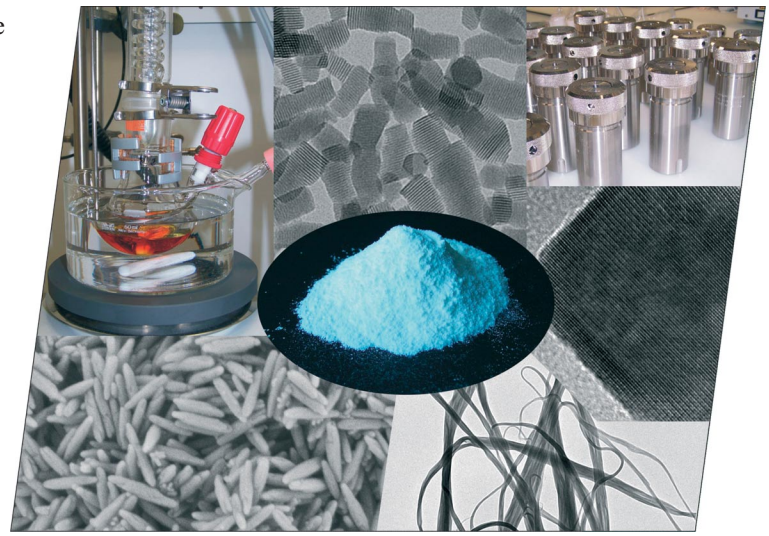
COVER PICTURE

The cover picture shows a selection of metal oxide nanoparticles and metal oxide based inorganic–organic hybrid nanostructures synthesized by liquid-phase routes. Molecular precursors are typically treated with a high-boiling and coordinating solvent either in a round-bottom flask (top left) or in autoclaves (top right). The electron microscopy images show vanadium oxide nanorods (bottom left), tungsten oxide nanofibers (bottom right), samarium oxide based hybrid nanoparticles and a part of an indium oxide nanocube (right) measured at high resolution. As-obtained barium titanate nanopowder is depicted in the center of the image. The cover was designed by Markus Niederberger and Nicola Pinna, Guest Editors of this special issue.

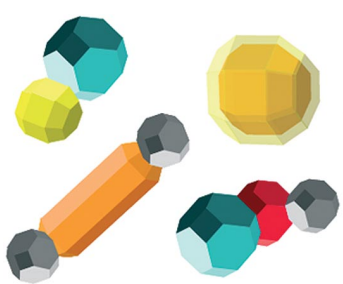


CONFERENCE REPORT

MICROREVIEW

Hybrid Nanocrystals

Keywords: Oxides / Nanocrystals / Colloidal synthesis / Surfactants / Topological control / Epitaxial growth / Hybrid nanomaterials

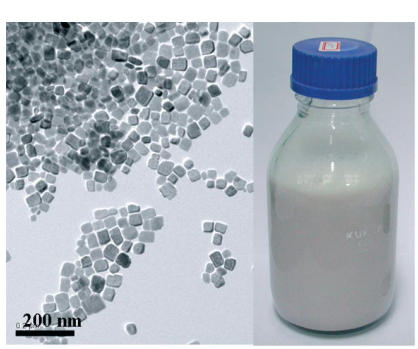


Hybrid nanocrystals (HNCs) are elaborate multifunctional nanoheterostructures, comprising size- and shape-tailored sections of different materials interconnected through inorganic junctions in defined spatial arrangements. Recent advances of colloidal chemistry approaches in the synthesis of oxide-based HNCs with topologically programmed architectures are reviewed and discussed.

SHORT COMMUNICATIONS

Ceria Nanoparticles

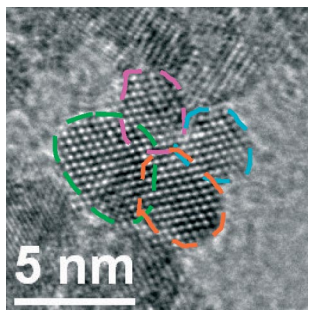
Keywords: Ceria / Nanoparticles / Sol–gel processes / Large-scale synthesis / Chemical mechanical polishing



We report the large-scale synthesis of uniform cube-shaped ceria nanocrystals by a sol–gel reaction in air. These ceria nanocrystals are readily dispersible in aqueous media without the addition of any extra dispersing agent, and they were successfully used as a slurry for chemical mechanical polishing.

Functionalized Oxide Nanocrystals

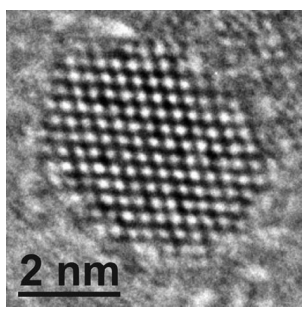
When a metal oxide sol is injected into a hot alkylamine, the condensation of the sol species is not hindered but limited to discrete spatial regions, defining the development of soluble nanocrystals, whose size is controlled by the metal concentration in the starting sol.



Keywords: Sol–gel processes / Synthesis design / Colloids / Nanostructures

Manganese Dopants

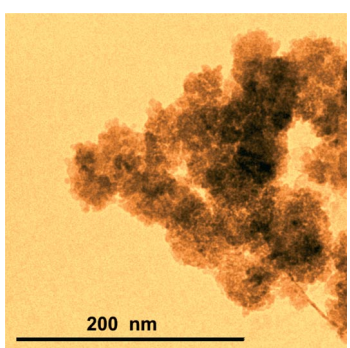
In search for high-temperature, ferromagnetic, diluted magnetic semiconductors, manganese-doped ZrO_2 nanoparticles were synthesized by a surfactant-free nonaqueous approach. High-quality 3-nm nanocrystals with uniform size and shape and a homogeneous distribution of the magnetic ion were obtained. They showed paramagnetic behavior of the diluted spins in the matrix.



Keywords: Zirconium / Manganese / Doping / Magnetic properties / Nanoparticles

ZnO Nanoparticles

The anodic behaviour of zinc was investigated in ethanol containing LiCl and water. A colloidal suspension of ZnO nanoparticles was obtained as a result of the dissolution of zinc in 0.1 M LiCl/ethanol solutions that contain H_2O. The concentration of H_2O directly influences the rate of the process and determines the size of nanoparticles.

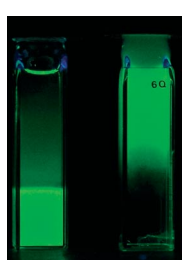


Keywords: Zinc / Nanostructures / Alcohols / Electrochemistry

FULL PAPERS

Luminescent Nanocrystals

Luminescent nanomaterials have been prepared based on a microwave-accelerated synthesis in ionic liquids. Based on the concept of synthesis, aspects of application are focused, including phase-transfer from polar to non-polar dispersants, formation of transparent thin layers as well as the realization of fully transparent dielectric barrier discharge (DBD) lamps.



Keywords: Nanomaterial / Luminescence / Ionic liquid / DBD lamp

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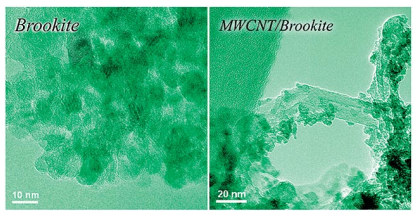
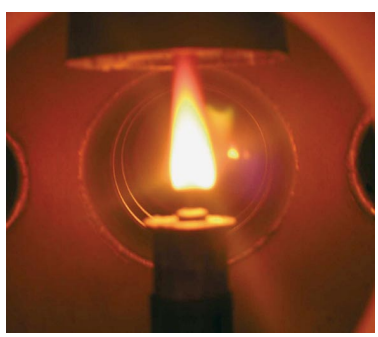
Li Ion Batteries



Keywords: Lithium-ion batteries / Electrochemistry / TiO_2 / Nanostructures / Intercalations / Conducting materials

This study examined the preparation of brookite-type TiO_2 nanoparticles by urea-mediated precipitation. Brookite was found to be an electrochemically active material, showing a strong particle size-dependent capacity. Multi-walled carbon nanotube/brookite nanocomposites were also synthesized and exhibited significantly improved capacity and cyclability.

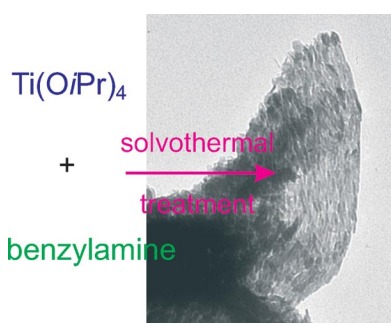
TiO_2 Synthesis by Laser Pyrolysis



Keywords: Laser pyrolysis / TiO_2 / TiON / Nanoparticles / Nanocrystals

TiO_2 and TiON nanoparticles have been obtained by laser synthesis. The anatase/rutile ratio of TiO_2 nanoparticles can be controlled over the range 85:15 to 10:90, and a correlation with optical properties in the UV/Vis range is demonstrated. The presence of N as a doping element strongly improves the absorption properties of the nanoparticles.

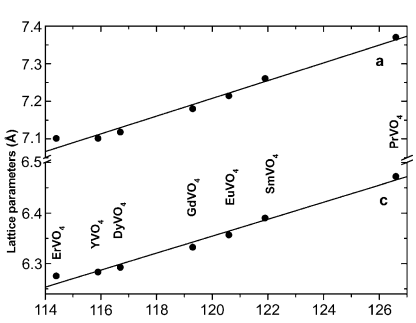
Layered Nanostructures



Keywords: Nanostructures / Layered compounds / Titanium / Nonaqueous synthesis / Hybrid materials

Nanocomposite structures of high ordering were obtained by a simple solvothermal treatment of titanium alkoxide in benzylamine as the solvent, without the use of any surfactants. The formed structures are shown to consist of ordered layers of anatase nanoplatelets intercalated by benzylamine. The solvent thus acts in multiple ways to provide shape control, and it also enables assembly.

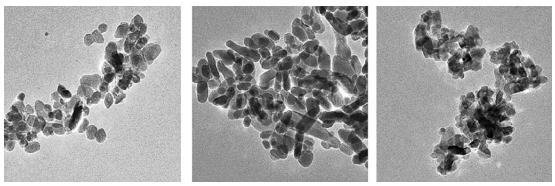
Rare Earth Vanadates



Keywords: Vanadates / Lanthanides / EDTA / Molecular precursors / Mixed oxides

Zircon-type AVO_4 (A = Y or Ln) materials were prepared by an alternative molecular precursor route at a moderate temperature of 800 °C and characterised by XRD, Raman and SEM. Solid solutions such as $Y_{1-x}Pr_xVO_4$ and $Y_{1-x}Gd_xVO_4$ are obtained, and linear correlations between chemical compositions and lattice parameters or Raman shifts are observed.

Hybrid Solar Cells

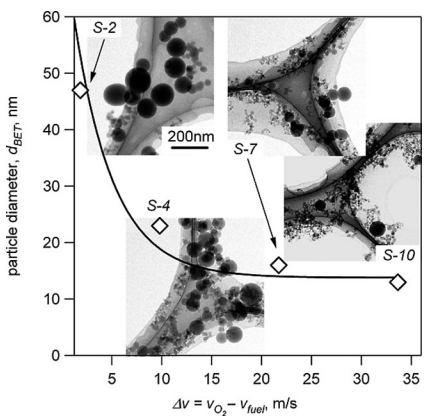


Solid-State Organic/Inorganic Hybrid Solar Cells Based on Poly(octylthiophene) and Dye-Sensitized Nanobrookite and Nanoanatase TiO_2 Electrodes

Sol-gel-prepared mesoporous brookite-TiO_2 thin coatings with differing initial particle size have been used to investigate solid-state dye-sensitized solar cells. An optimum conversion efficiency has been reached (η_e = 0.48%). Higher performances (η_e = 0.74%) have been achieved with anatase using the same photovoltaic-device fabrication process.

Keywords: Solar cells / TiO_2 nanoparticles / Brookite / Photovoltaic / DSSC

Silica Nanostructure Evolution

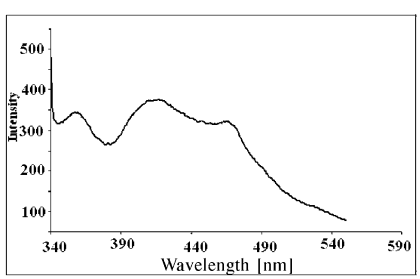


Nanostructure Evolution: From Aggregated to Spherical SiO_2 Particles Made in Diffusion Flames

The tailoring of the size and morphology of SiO_2 nanoparticles in a diffusion flame (*S-y*) from large but non-aggregated to small but aggregated particles was investigated. This was achieved by the introduction of flame turbulence by variation of the O_2 flow rate (*y* L/min).

Keywords: Nanoparticles / Silica / Diffusion flame / SAXS

Encapsulating Carbon Vesicles



Synthesis, Characterization, and Photoluminescence Properties of In_2O_3 Nanocrystals Encapsulated by Carbon Vesicles and Neat In_2O_3 Nanocrystals Generated by the RAPET Technique

The product In_2O_3@C is synthesized by the thermal decomposition of In(acetate)$_3$ at a relatively low reaction temperature (800 °C) in a closed Letlok reactor. This method is called the RAPET (reactions under autogenic pressure at elevated temperatures) technique.

Keywords: Decomposition / Indium / Luminescence / Nanocrystals / Vesicles

Fuels for Combustion Synthesis

Peculiarities of $CaO{\cdot}6AlO_3$ Formation by using Low-Temperature Combustion Synthesis

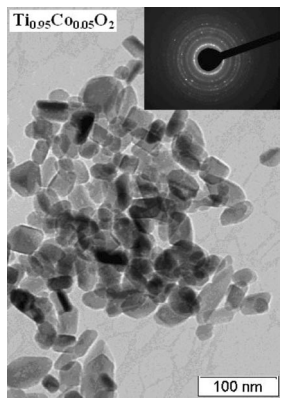
An alternative for the solution combustion synthesis of $CaO{\cdot}6Al_2O_3$ was developed. A two-fuel mixture containing the most suitable fuel for each metal nitrate was used: urea for aluminium nitrate and β-alanine for calcium nitrate. In this case, the formation of pure $CaO{\cdot}6Al_2O_3$ was achieved directly from the combustion reaction, without any additional thermal treatment.

Keywords: Combustion synthesis / X-ray diffraction / Calcium / Aluminium

CONTENTS

Doped TiO_2 Nanoparticle Films

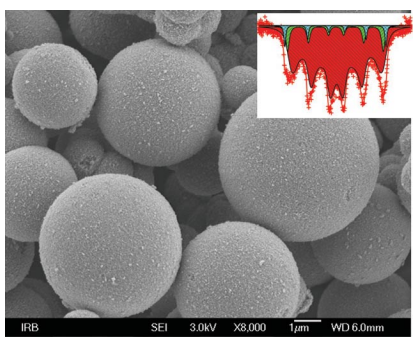
This paper reports on a new and swift chemical route to synthesise highly stable anatase single-phase Co- and Fe-doped TiO_2 nanoparticles, with dopant concentrations of up to 10 at.-% and mean grain sizes that range between 20 and 30 nm.



Keywords: Diluted magnetic semiconductors / Co- and Fe-doped TiO_2 anatase nanocrystallites / Hydrothermal synthesis / $TiCl_3$

Nanocrystalline Iron Oxides

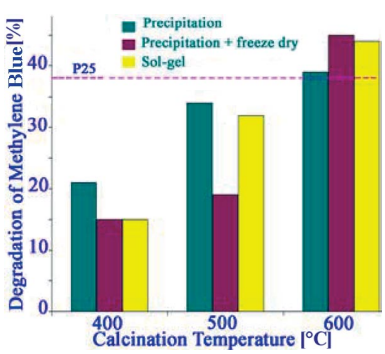
Treatment of iron(III) acetate in ethanol under solvothermal conditions produced nanosized magnetite particles aggregated in micrometre regular spheres. Upon the addition of acetic acid, water molecules generated in an esterification reaction participated in the hydrolysis to form exclusively nanosized hematite particles.



Keywords: Acetates / Magnetite / Hematite / Esterification / Solvothermal synthesis

Titanium Dioxide in Photocatalysis

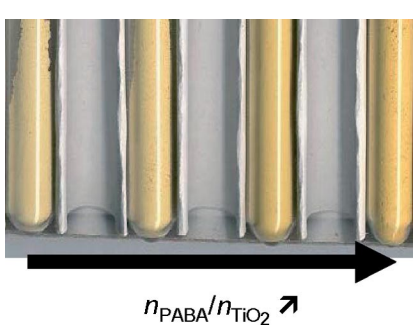
A comparative study of TiO_2 powders prepared by precipitation and sol–gel methods along with different drying procedures was conducted. Nanocrystalline anatase was stable up to 600 °C without any pretreatment. The photocatalytic activity of TiO_2 was found to highly dependent on the calcination temperature, but independent of the synthesis and drying methods.



Keywords: Titanium / Sol–gel / Precipitation / Freeze drying / Photocatalysis

Hybrid Nanoparticles

Heteroleptic titanium alkoxide was used in a one-step, simple, efficient, low-temperature (100 °C) and aqueous sol–gel synthetic method to afford crystalline amino acid surface-modified titania nanoparticles ($n$$TiO_2$/PABA). This green process allowed precise control of the organic loadings to tailor the efficacy of the nanohybrids against UVA+UVB radiations.



Keywords: Molecular precursor / Sol–gel / Nanoparticles / Hybrids / Titanium

If not otherwise indicated in the article, papers in issue 5 were published online on January 30, 2008

