

# Journal of Materials Chemistry

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## IN THIS ISSUE

ISSN 0959-9428 CODEN JMACEP 20(21) 4233–4460 (2010)



### Cover

See G. Jutz and A. Böker, pp. 4299–4304.  
Protein and bionanoparticle stabilized Pickering emulsions as novel approaches for the synthesis of (bio-)inorganic hybrid materials.  
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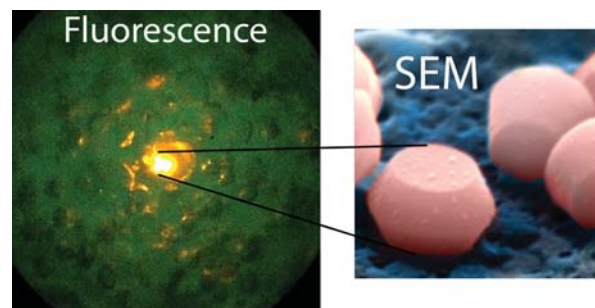
## HIGHLIGHT

4247

### Ultrabright fluorescent mesoporous silica particles

I. Sokolov\* and D. O. Volkov

A special nanoenvironment of mesoporous silica allows very high fluorescence to be attained from the encapsulated dye. This paper highlights this technology.



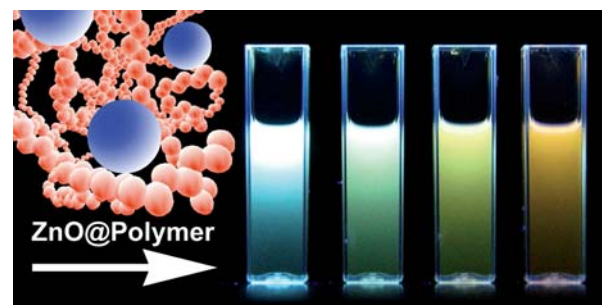
## FEATURE ARTICLE

4251

### Photoluminescent ZnO nanoparticles modified by polymers

Huan-Ming Xiong\*

This review covers the past decade's researches on photoluminescent polymer–ZnO nanocomposites with various structures and novel luminescent mechanisms.



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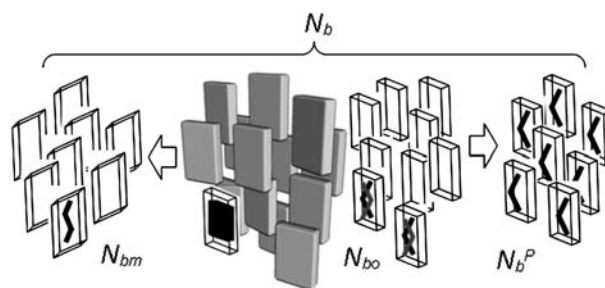
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4263

**Biaxial nematic phases**

Carsten Tschierske\* and Demetri J. Photinos\*

An overview of the current state of research in the field of biaxial nematic liquid crystalline materials is given, including theoretical concepts, characterization techniques and recent progress in the design of potential biaxial nematic materials with bent-core molecules.



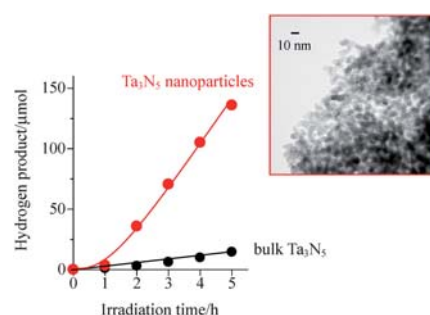
## COMMUNICATION

4295

**Highly active tantalum(v) nitride nanoparticles prepared from a mesoporous carbon nitride template for photocatalytic hydrogen evolution under visible light irradiation**

Leny Yuliati, Jae-Hun Yang, Xinchun Wang, Kazuhiko Maeda, Tsuyoshi Takata, Markus Antonietti and Kazunari Domen\*

Ta<sub>3</sub>N<sub>5</sub> nanoparticles, which were successfully prepared for the first time using a mesoporous carbon nitride template, showed high activity for hydrogen evolution.



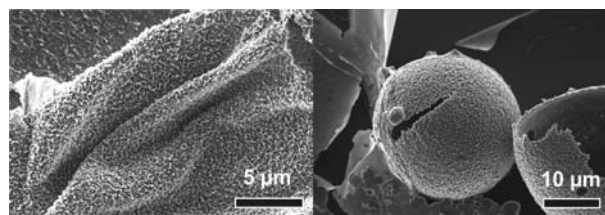
## PAPERS

4299

**Bio-inorganic microcapsules from templating protein- and bionanoparticle-stabilized Pickering emulsions**

Günther Jutz\* and Alexander Böker\*

Protein and bionanoparticle stabilized Pickering oil-in-water emulsions were used as a versatile scaffold for the synthesis of bio-inorganic hybrid capsules through mineralization with calcium phosphate. Different (biomimetic) mineralization procedures allowed us to control the capsule shell thickness and morphology.

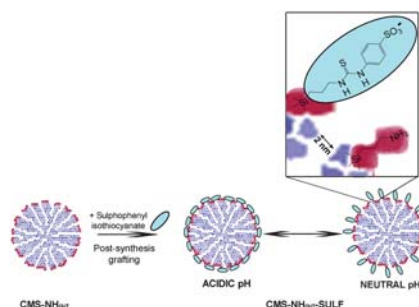


4305

**Controlling the delivery kinetics from colloidal mesoporous silica nanoparticles with pH-sensitive gates**

Valentina Cauda, Christian Argyo, Axel Schlossbauer and Thomas Bein\*

Amino functionalities and sulfonate groups located at the pore entrance of colloidal mesoporous silica permit a pH-dependent control of drug release from the pores.

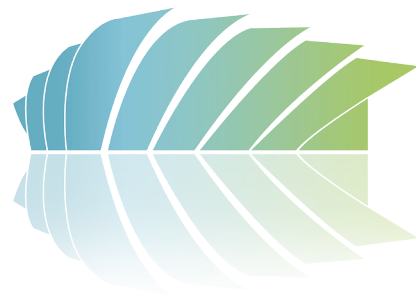


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Fudan University, China

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University of Wisconsin-Madison, USA

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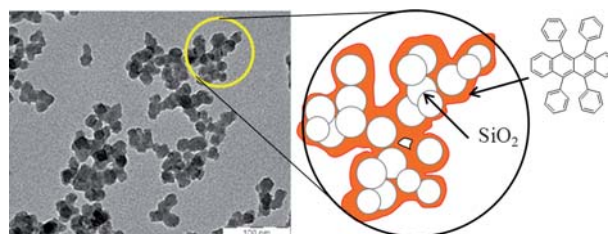


4312

### Properties of core-shell structured nanopowders of molecular crystals fabricated by dry grinding

Kunihiro Ichimura,\* Ken'ichi Aoki, Haruhisa Akiyama, Shin Horiuchi, Shusaku Nagano and Shinji Horie

The dry grinding of a mixture of molecular crystals and silica nanoparticles provides a generic way to powdery core-shell nanoparticulates. Crystalline shells exhibit nanosize effects on fluorescence and melting behaviour.



4321

### Tamarind seed xyloglucan – a thermostable high-performance biopolymer from non-food feedstock

Joby Kochumalayil, Houssine Sehaoui, Qi Zhou\* and Lars A. Berglund\*

A comprehensive study on tamarind seed xyloglucan as a thermostable biopolymer with film-forming ability, high Young's modulus and tensile strength combined with ductile behavior.

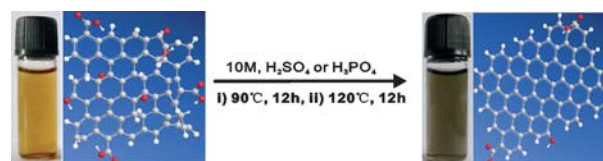


4328

### A dehydration and stabilizer-free approach to production of stable water dispersions of graphene nanosheets

Jin-Long Chen and Xiu-Ping Yan\*

Concentrated sulfuric acid or phosphoric acid as dehydrating and intercalating reagent provides a dehydration and stabilizer-free method for facile production of water dispersions of graphene with unusual self-assembly properties



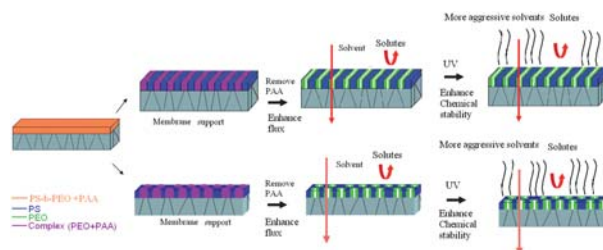
Carbon in grey, oxygen in red and hydrogen in white

4333

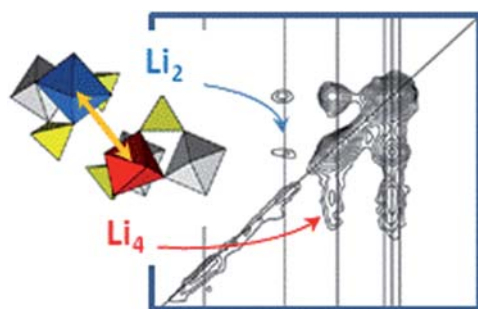
### Ordered nanoporous membranes based on diblock copolymers with high chemical stability and tunable separation properties

Xianfeng Li, Charles-André Fustin,\* Nathalie Lefèvre, Jean-François Gohy, Steven De Feyter, Jérémie De Baerdemaeker, Werner Egger and Ivo F. J. Vankelecom\*

A simple method is reported to directly produce ordered nanoporous membranes on porous supports. The permeability and chemical stability of the membranes can be easily tuned without changing membrane morphology.



4340

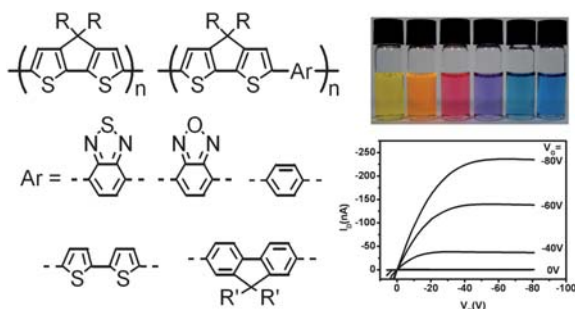


### Synthesis of $\text{Li}_4\text{V}(\text{PO}_4)_2\text{F}_2$ and ${}^6,7\text{Li}$ NMR studies of its lithium ion dynamics

L. S. Cahill, Y. Iriyama, L. F. Nazar\* and G. R. Goward\*

$\text{Li}_5\text{V}(\text{PO}_4)_2\text{F}_2$  has been shown to be a promising candidate cathode material for lithium ion batteries. The delithiation of the title compound provides lithium vacancies and increases mobility among the remaining lithium ions. As shown by  ${}^7\text{Li}$  EXSY NMR, new exchange partners, such as  $\text{Li}_2$  and  $\text{Li}_4$  in this case, become available, and the dynamics are enhanced compared to the parent material.

4347

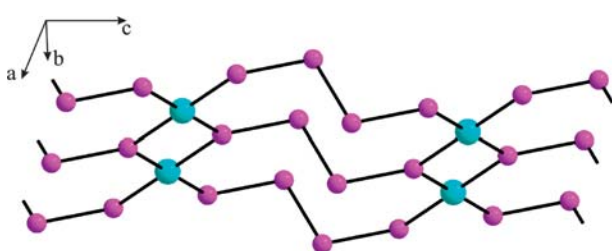


### Cyclopentadithiophene based polymers—a comparison of optical, electrochemical and organic field-effect transistor characteristics

Masaki Horie, Leszek A. Majewski, Michael J. Fearn, Chin-Yang Yu, Yi Luo, Aimin Song, Brian R. Saunders\* and Michael L. Turner\*

The band gaps and colours of cyclopentadithiophene copolymers can be systematically varied by changing the backbone structure.

4356

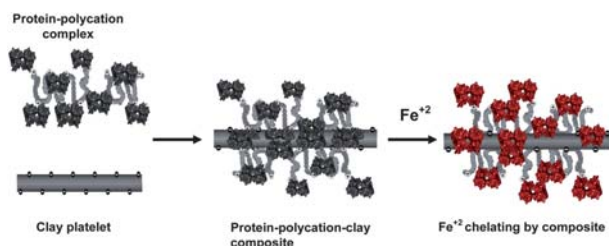


### Crystal structure and physical properties of the new silicide $\text{Hf}_4\text{CuSi}_4$ with planar $\text{CuSi}_4$ rectangles

Mykhailo Guch, Abdeljalil Assoud and Holger Kleinke\*

$\text{Hf}_4\text{CuSi}_4$  contains planar  $\text{CuSi}_4$  rectangles interconnected to chains and *via*  $\text{Si}_4^{10-}$  zigzag chains to infinite puckered layers. The material is metallic, exhibiting a distinct pseudo-band gap at 0.45 eV above the Fermi level.

4361



### Bioactive apo-ferredoxin-polycation-clay composites for iron binding

Adi Radian, Dorit Michaeli, Carina Serban, Rachel Nechushtai and Yael G. Mishaël\*

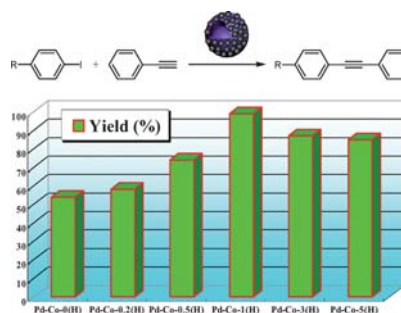
Protein-polycation-clay composites were tailored for specific bio-chelating of iron.

4366

### Hollow palladium–cobalt bimetallic nanospheres as an efficient and reusable catalyst for Sonogashira-type reactions

Hui Li,\* Zhonghong Zhu, Jun Liu, Songhai Xie and Hexing Li\*

Hollow Pd–Co nanospheres are fabricated through a vesicle-assisted chemical reduction method. Their composition can be tuned, which provides a level of reactivity control during Sonogashira-type coupling reactions in aqueous medium.

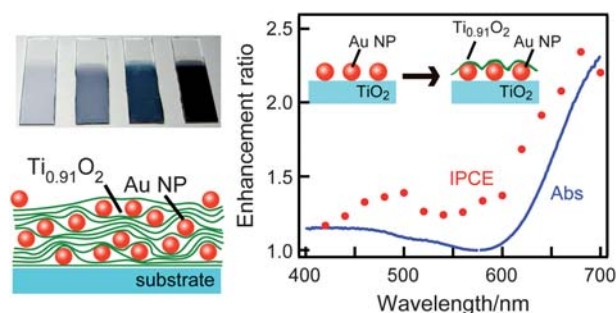


4371

### Layer-by-layer assembly of gold nanoparticles with titania nanosheets: control of plasmon resonance and photovoltaic properties

Nobuyuki Sakai, Takayoshi Sasaki, Kazuki Matsubara and Tetsu Tatsuma\*

Design of the layered structure allowed enhancement of plasmon resonance, control of plasmon coupling, enhancement of plasmon-based photocurrents and switching of the photocurrent direction.



4379

### Double-responsive polyampholyte as a nanoparticle stabilizer: application to reversible dispersion of gold nanoparticles

Shenghai Li, Yuntao Wu, Junhua Wang, Qiang Zhang, Yongli Kou and Suobo Zhang\*

Au nanoclusters were supported on pH- and solvent-responsive a water-soluble polyampholyte (Au@SPES), which underwent a precipitation-redispersion process and permitted a facile separation of the clusters without any negative aggregation.



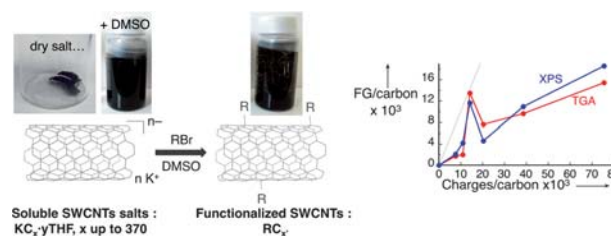
4385



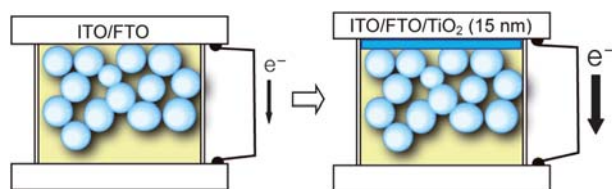
### Stoichiometric control of single walled carbon nanotubes functionalization

Damien Voiry, Olivier Roubeau\* and Alain Pénicaud

Stoichiometric control and absence of selectivity in the covalent functionalization of SWCNTs are obtained through soluble, reduced SWCNT salts.



4392

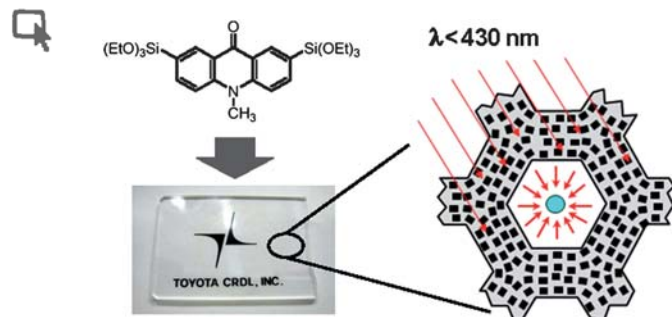


### Enhanced charge collection efficiency by thin-TiO<sub>2</sub>-film deposition on FTO-coated ITO conductive oxide in dye-sensitized solar cells

Beomjin Yoo, Kyungkun Kim, Doh-Kwon Lee, Min Jae Ko,\* Hyunjung Lee, Yong Hyun Kim, Won Mok Kim and Nam-Gyu Park\*

A thin TiO<sub>2</sub> layer 15 nm thick was deposited on an ITO/FTO bilayered transparent conductive substrate by radio frequency magnetron sputtering, which improved charge collection efficiency from 90% to 97% in dye-sensitized solar cells.

4399

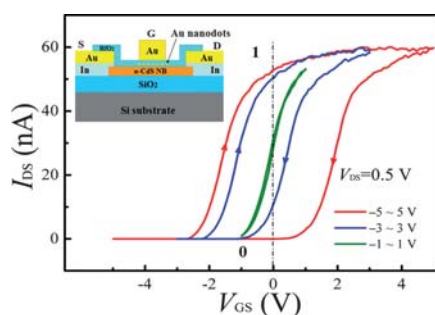


### Transparent and visible-light harvesting acridone-bridged mesostructured organosilica film

Yoshifumi Maegawa, Norihiro Mizoshita, Takao Tani and Shinji Inagaki\*

Capping of nitrogen atom in the acridone-bridged sol-gel precursor led to a successful formation of transparent and visible-light harvesting mesostructured organosilica film.

4404

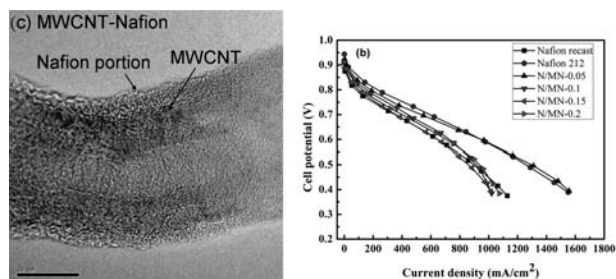


### High-performance non-volatile CdS nanobelt-based floating nanodot gate memory

P. C. Wu, Y. Dai, Y. Ye, X. L. Fang, T. Sun, C. Liu and L. Dai\*

Non-volatile Au nanodot embedded floating gate memories based on CdS nanobelts are fabricated. The as-fabricated devices have good properties, such as large memory windows, long retention times, and good stress endurance.

4409



### Preparation and applications of Nafion-functionalized multiwalled carbon nanotubes for proton exchange membrane fuel cells

Ying-Ling Liu,\* Yu-Huei Su, Chia-Ming Chang, Suryani, Da-Ming Wang and Juin-Yih Lai

Nafion-functionalized multiwalled carbon nanotubes are effective additives for increasing the proton conductivity and single cell performance of Nafion membranes.



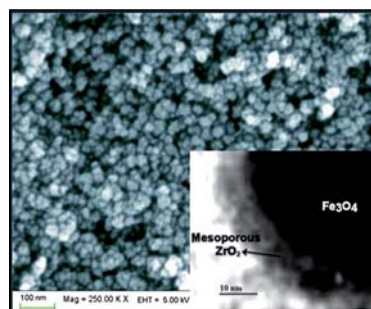
4417



### Design of a new nanostructure comprising mesoporous $\text{ZrO}_2$ shell and magnetite core ( $\text{Fe}_3\text{O}_4@\text{mZrO}_2$ ) and study of its phosphate ion separation efficiency

Arpita Sarkar, Soumya Kanti Biswas  
and Panchanan Pramanik\*

As a plausible candidate in controlling the eutrophication of surface water, a new nanosized core/shell structure comprising of a magnetite core and a mesoporous  $\text{ZrO}_2$  shell ( $\text{Fe}_3\text{O}_4@\text{mZrO}_2$ ) with a BET surface area of  $107 \text{ m}^2 \text{ g}^{-1}$  and an accessible mesopore size of 3.9 nm has been synthesized and its phosphate removal efficiency investigated.



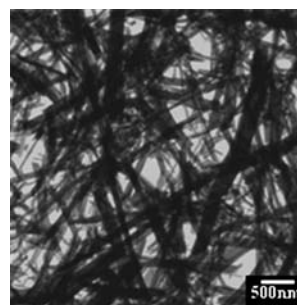
4425



### A facile nonaqueous route for fabricating titania nanorods and their viability in quasi-solid-state dye-sensitized solar cells

Jaykrushna Das, Flavio S. Freitas, Ivana R. Evans,  
Ana F. Nogueira and Deepa Khushalani\*

A facile and simple synthesis of titanium glycerolate nanofibers (using glycerol as both a solvent and a chelating agent) and its conversion to high surface area anatase fibers is detailed. These nanorods have been used as a photoanode to fabricate a DSSC using a gel polymer electrolyte.



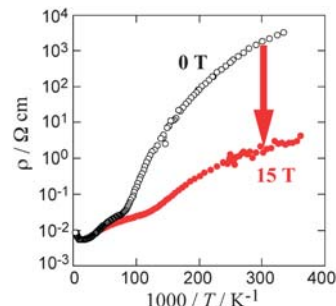
4432



### Giant magnetoresistance response by the $\pi$ -d interaction in an axially ligated phthalocyanine conductor with two-dimensional $\pi$ - $\pi$ stacking structure

Manabu Ishikawa, Takehiro Asari, Masaki Matsuda,  
Hiroyuki Tajima, Noriaki Hanasaki, Toshio Naito  
and Tamotsu Inabe\*

Extremely large negative magnetoresistance effect has been observed for the phthalocyanine-based  $\pi$ -d conductor with two-dimensional  $\pi$ - $\pi$  stacking structure.



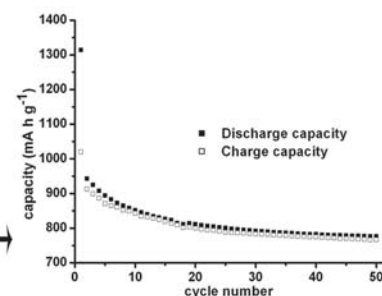
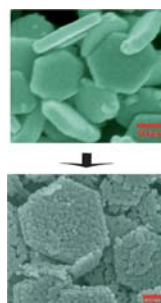
4439



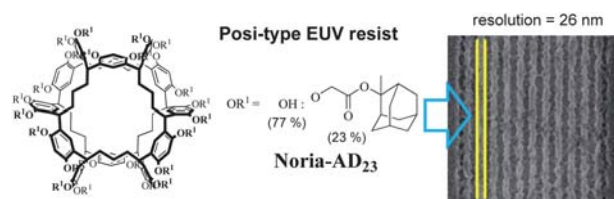
### A novel nanostructured spinel $\text{ZnCo}_2\text{O}_4$ electrode material: morphology conserved transformation from a hexagonal shaped nanodisk precursor and application in lithium ion batteries

Yongcai Qiu, Shihe Yang,\* Hong Deng, Limin Jin  
and Weishan Li\*

Porous  $\text{ZnCo}_2\text{O}_4$  nanoflakes can now be created by thermal decomposition of inorganic-organic-inorganic layered hybrid nanodisks, which, as an anode for lithium ion batteries, have shown high capacity and high cyclability.



4445

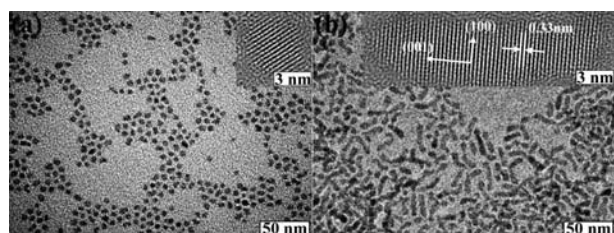


### Novel extreme ultraviolet (EUV)-resist material based on noria (water wheel-like cyclic oligomer)

Hiroto Kudo, Yuji Suyama, Hiroaki Oizumi, Toshiro Itani and Tadatomi Nishikubo\*

The synthesized noria-AD<sub>23</sub> provided a clear line and space pattern with a resolution of 26 nm and a line-edge roughness (LER) of 8.3 nm.

4451



### “One-pot” synthesis and shape control of ZnSe semiconductor nanocrystals in liquid paraffin

Yi Liu, Yue Tang, Yang Ning, Minjie Li, Hao Zhang\* and Bai Yang

High-quality ZnSe nanocrystals (NCs) were synthesized in liquid paraffin through a “one-pot” strategy. The materials were low-cost and environmentally friendly, which would facilitate the commercial scale synthesis of ZnSe NCs.

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