Cancer Therapy

In article 1600229, Shilong Wang, Rongrong Zhu, Yechang Qian, and co-workers investigate the anti-metastatic and anti-angiogenic effects of SiO$_2$@LDH (LDH: layered double hydroxide) loaded with etoposide (VP16). SiO$_2$@LDH has very suitable qualities as drug delivery agent and enhances the anti-metastatic action of VP16 both in vitro and in vivo. Enhanced anti-angiogenic efficacy is also proven which might contribute to the anti-cancer action. The cover image represents the 3D structure of core-shell SiO$_2$@LDH-VP16, which silicon dioxide sphere flexibly enclosed by double-layered hydroxide.

Light-Emitting Devices

Andrey L. Rogach and co-workers describe the enhanced emission of photoluminescent copper nanoclusters in solution and in powder state, in article 1600182. These blue- and orange-emitting Cu nanoclusters are combined to create white light-emitting devices.

Tumor Marker Detection

In article 1600197, Xueyuan Chen and co-workers report a novel luminescent bioassay technique, namely, dissolution-enhanced luminescence bioassay based on inorganic lanthanide nanoprobes, for ultrasensitive in-vitro detection of tumor markers in human sera or saliva, such as carcinoembryonic antigen, prostate specific antigen and alpha-fetoprotein, with detection sensitivities several orders of magnitude improvement relative to current commercial bioassays.
**Theranostics**

G. Lin, P. Mi, C. Chu, J. Zhang, G. Liu* ........................................ 1600134

Inorganic Nanocarriers Overcoming Multidrug Resistance for Cancer Theranostics

Inorganic nanocarriers provide multifunctional platforms for cancer theranostics. They could load several kinds of bioactive compounds to achieve synergistic effects for eradicating multidrug resistant (MDR) cancers, as well as by combining different treatment manners. These inorganic nanocarriers could also provide imaging functions for imaging-guided drug delivery against MDR cancers, including cancer diagnosis, mechanism study, as well as monitoring the therapeutic effects.

**Photocatalysts**

H. Li, W. Tu, Y. Zhou, Z. Zou* .................................................. 1500389

Z-Scheme Photocatalytic Systems for Promoting Photocatalytic Performance: Recent Progress and Future Challenges

Recent accomplishments of state-of-the-art Z-scheme systems are summarized and highlighted, categorized according to diverse modes, including i) with shuttle redox mediators, ii) without electron mediators, and iii) with solid-state electron mediators. The challenges and prospects for future development of Z-scheme photocatalytic systems are also presented.

**PROGRESS REPORT**

**Tumor Marker Detection**

W. Zheng, S. Y. Zhou, J. Xu, Y. S. Liu, P. Huang, Y. Liu, X. Y. Chen* ... 1600197

Ultrasensitive Luminescent In Vitro Detection for Tumor Markers Based on Inorganic Lanthanide Nano-Bioprobes

A brief overview of recent efforts on the development of inorganic lanthanide nanoparticles as efficient luminescent nano-bioprobes for the ultrasensitive in vitro biodetection of tumor markers, with an emphasis on the dissolution-enhanced luminescent bioassay, an emerging technique recently developed toward practical medical applications is reported in this progress report.
The corrugated layer structure bismuth has been successfully tailored into negative thermal expansion along c axis by size effect. Pair distribution function and extended X-ray absorption fine structure are combined to reveal the local structural distortion for nanosized bismuth. The comprehensive method to identify the local structure of nanomaterials can benefit the regulating and controlling of thermal expansion in nanodevices.

A large manifold of nontrivial spin textures, including the stabilization of monopole-like fields, are generated by using a completely new and versatile approach based on the combination of superconductivity and magnetism. Robust, stable, and easily controllable complex spin structures are encoded, modified, and annihilated in a continuous magnetic thin film by defining a variety of magnetic states in superconducting dots.

A MoSe₂/Si heterojunction photodetector is constructed by depositing MoSe₂ film with vertically standing layered structure on Si substrate. Graphene transparent electrode is utilized to further enhance the separation and transport of photogenerated carriers. The device shows excellent performance in terms of wide response spectrum of UV–visible–NIR, high detectivity of \(7.13 \times 10^{10}\) Jones, and ultrafast response speed of \(\approx 270\) ns, unveiling the great potential for the heterojunction for high-performance optoelectronic devices.
**Light-Emitting Devices**

Z. Wang, B. Chen, A. S. Susha, W. Wang, C. J. Reckmeier, R. Chen, H. Zhong, A. L. Rogach*.............1600182

**All-Copper Nanocluster Based Down-Conversion White Light-Emitting Devices**

Photoluminescence of blue and orange emitting Cu nanoclusters (NCs) is enhanced by surface treatment with sodium citrate and the solvent induced aggregation, respectively, resulting in high quantum yields of 14% and 43% in the solid state. White light emitting diodes are fabricated using powdered Cu NCs as phosphors, with a high color rendering index of 92 and low correlated color temperature of 4163 K.

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**Cancer Therapy**

Y. Zhu, R. Zhu,* M. Wang, B. Wu, X. He, Y. Qian,* S. Wang*............1600229

**Anti-Metastatic and Anti-Angiogenic Activities of Core–Shell SiO$_2$@LDH Loaded with Etoposide in Non-Small Cell Lung Cancer**

A novel nanoparticle SiO$_2$@LDH is used to load the anti-cancer drug etoposide. Enhanced anti-metastatic effect can be observed on non-small cell lung cancer both in vitro and in vivo. Anti-angiogenesis action, inhibition of PI3K-AKT, and FAK-Paxillin pathway may be considered as the possible mechanism. SiO$_2$@LDH with fine quality provides a potential drug-delivery system in anti-cancer treatment.

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**Metal–Organic Frameworks**

H. Xu, X.-F. Liu, C.-S. Cao, B. Zhao,* P. Cheng, L.-N. He*.................1600048

**A Porous Metal–Organic Framework Assembled by [Cu$_{30}$] Nanocages: Serving as Recyclable Catalysts for CO$_2$ Fixation with Aziridines**

A unique porous framework assembled by nano-sized and censer-like [Cu$_{30}$]-cages can enrich methylene blue and capture CO$_2$. Importantly, 1 can effectively catalyze the cycloaddition reaction with CO$_2$ and aziridines, and can be reused for at least ten times. It represents the first example of metal–organic frameworks–based catalyst for CO$_2$ conversion with aziridines.

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**Layered Oxides**

P. Oh, S.-M. Oh, W. Li, S. Myeong, J. Cho, A. Manthiram*..............1600184

**High-Performance Heterostructured Cathodes for Lithium-Ion Batteries with a Ni-Rich Layered Oxide Core and a Li-Rich Layered Oxide Shell**

To develop high-performance cathodes, a heterostructure composed of Ni-rich layered oxide core and a lithium-rich Li$_{1.2}$Ni$_{0.2}$Mn$_{0.6}$O$_2$ shell is explored. The heterostructure overcomes the critical drawbacks of both the surface electrochemical instability with electrolyte of the core material as well as the voltage decline problem of the shell layer.
A high-performance, precious-metal-free highly porous graphene cathode is demonstrated in real direct methanol fuel cells, exceeding the performance of a Pt cathode.

Ultrathin nanosheets constructed titania hierarchical hollow spheres are successfully fabricated by a self-templated strategy. Such unique hierarchical TiO₂ hollow spheres with high specific area exhibit excellent rate capability and good cycle stability even at a high current density of ~10 C for the anode material of Li-ion battery.

Low sound velocity leads to low lattice thermal conductivity, motivating the exploration of high-performance thermoelectric Ag₈SnSe₆.

A free-standing and tunable graphene mesoporous structure/single-walled carbon nanotube hybrid membrane is designed and prepared. Amorphous molybdenum sulfide (MoS₂) is electrodeposited on this platform and excellent hydrogen evolution reaction performance is achieved, thanks to the large surface area for MoS₂ deposition, as well as the efficient electron transport and abundant active sites on the amorphous MoS₂ surface.
FULL PAPERS

Water Splitting

C. Y. Ling, L. Shi, Y. X. Ouyang, Q. Chen, J. L. Wang*................. 1600180

Transition Metal-Promoted V₂CO₂ (MXenes): A New and Highly Active Catalyst for Hydrogen Evolution Reaction

A new highly active catalyst: transition metal-promoted V₂CO₂ for hydrogen evolution reaction is predicted by means of first principle calculations. The calculated reaction free energies for hydrogen adsorption (ΔGₚ) can reach to the optimal value ~0 eV with high stability and robustness upon external tensile or compressive strain.

Silia Nanoparticles

S. Goel, F. Chen, S. Luan, H. F. Valdovinos, S. Shi, S. A. Graves, F. Ai, T. E. Barnhart, C. P. Theuer, W. Cai*................................. 1600122

Engineering Intrinsically Zirconium-89 Radiolabeled Self-Destructing Mesoporous Silica Nanostructures for In Vivo Biodistribution and Tumor Targeting Studies

Self-destructing, intrinsically zirconium-89 labeled mesoporous silica nanoparticles are reported for angiogenesis-targeted positron emission tomography in metastatic breast tumor models. The simple and versatile approach paves way for future personalized nanotheranostics through simple surface modifications; to label a wide range of clinically relevant radioisotopes bypassing specific chelator chemistries, carry multiple drug cargos for combination therapy and target multiple tumor types.

Whispering-Gallery Modes

X. F. Liu,* L. Niu, C. Y. Wu, C. X. Cong, H. Wang, Q. S. Zeng, H. Y. He, Q. D. Fu, W. Fu, T. Yu, C. H Jin, Z. Liu,* T. C. Sum*................. 1600137

Periodic Organic–Inorganic Halide Perovskite Microplatelet Arrays on Silicon Substrates for Room-Temperature Lasing

Room-temperature high-quality factor whispering-gallery-mode lasing is demonstrated (Q ≈ 1210) from patterned lead halide perovskite microplatelets arrays on silicon substrate. By varying the size of the platelets, modal selectivity for single mode lasing can be achieved with different cavity sizes or by simply breaking the structural symmetry of the cavity through the patterning.