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Nanomaterials for radiotherapeutics-based multimodal synergistic cancer therapy

Nanotechnologies for enhancing cancer immunotherapy

Advances of biological-camouflaged nanoparticles delivery system

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Contents

Review Articles

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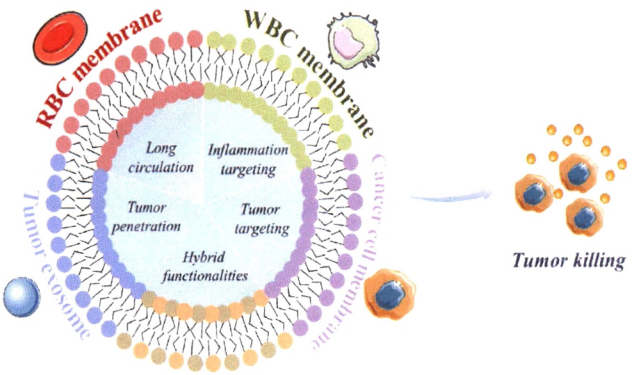
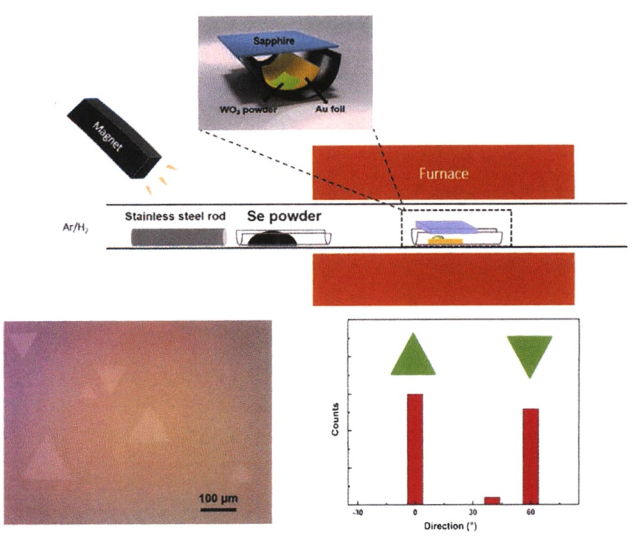


Different cell membrane-coated nanoparticles are used for tumor therapy.

Research Articles

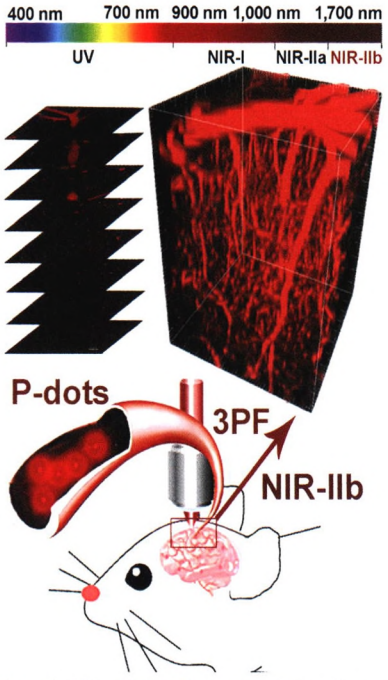


Gold vapor was introduced into the chemical vapor deposition (CVD) process as a catalyst to assist the growth of WSe_2. Highly aligned monolayer WSe_2 triangular flakes with large domain size (130 μm) and fast growth rate (4.3 $\mu m \cdot s^{-1}$), and continuous monolayer films with good uniformity were achieved.

NIR-IIb excitable bright polymer dots with deep-red emission for *in vivo* through-skull three-photon fluorescence bioimaging

Nuernisha Alifu[1,2], Abudureheman Zebibula[2], Hequn Zhang[2], Huwei Ni[2], Liang Zhu[2], Wang Xi[2,*], Yalun Wang[2], Xueliang Zhang[1,*], Changfeng Wu[3], and Jun Qian[2,*]

[1] Xinjiang Medical University, China
[2] Zhejiang University, China
[3] South University of Science and Technology, China

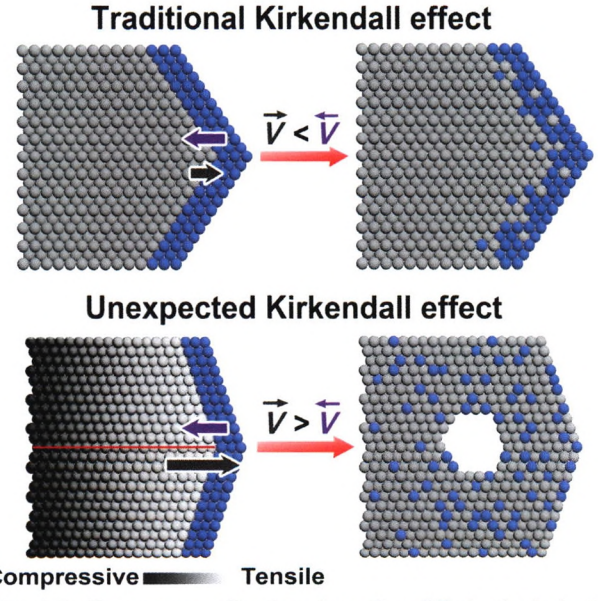


The near-infrared IIb (NIR-IIb) excitable deep-red emissive semiconducting polymer dots (P-dots) with bright three-photon fluorescence (3PF) under 1,550 nm fetmosecond laser excitation were prepared and functionalized. Then the P-dots were utilized for *in vivo* 3PF cerebral vasculature microscopic imaging of mice with and without the brain skull.

Unexpected Kirkendall effect in twinned icosahedral nanocrystals driven by strain gradient

Jingbo Huang[1], Yucong Yan[1,2], Xiao Li[1], Xurong Qiao[3], Xingqiao Wu[1], Junjie Li[1], Rong Shen[1], Deren Yang[1,*], and Hui Zhang[1,*]

[1] Zhejiang University, China
[2] SAIC Motor Corporation Limited, China
[3] China University of Petroleum, China

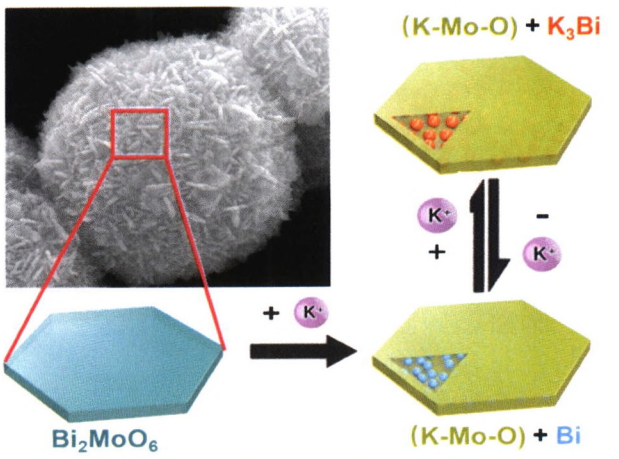


Kirkendall effect unexpectedly takes place when diffusing intrinsically faster Cu atoms into Pd icosahedra. The strain gradient arising from the multiple twins of the icosahedra is the key to drive such Kirkendall effect, leading to the formation of hollow structures.

Unveiling nanoplates-assembled Bi_2MoO_6 microsphere as a novel anode material for high performance potassium-ion batteries

Junxian Hu, Yangyang Xie, Jingqiang Zheng, Yanqing Lai, and Zhian Zhang*

Central South University, China

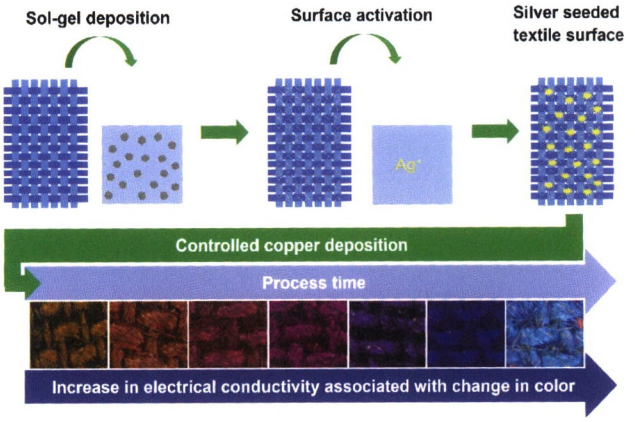


Bi_2MoO_6 microsphere assembled by two-dimensional (2D) nanoplate exhibits good potassium storage performance and performs a combination mechanism of conversion reaction and alloying/dealloying reaction.

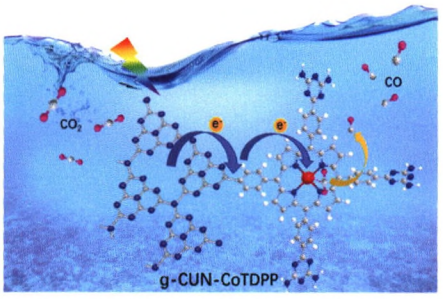
Tunable colors and conductivity by electroless growth of Cu/Cu_2O particles on sol-gel modified cellulose

Justus Landsiedel[1,*], Waleri Root[1], Christian Schramm[1], Alexander Menzel[1], Steffen Witzleben[2], Thomas Bechtold[1], and Tung Pham[1,*]

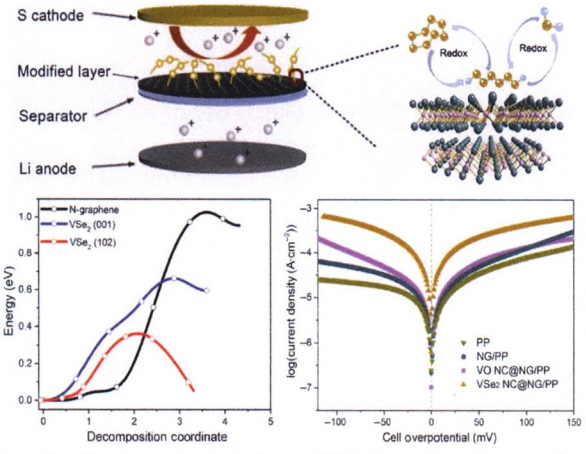
[1] University of Innsbruck, Austria
[2] Bonn-Rhein-Sieg University of Applied Sciences, Germany



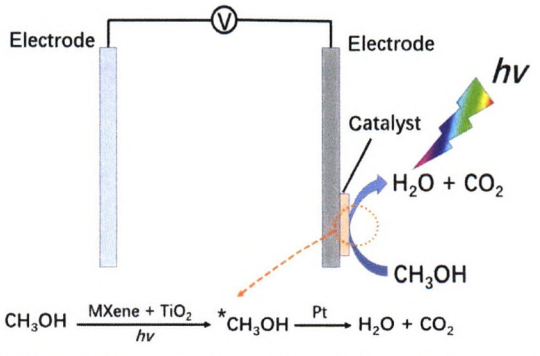
In situ growth and immobilization of copper nanoparticles on cellulose textiles results in tunable coloration and electrical conductivities.



The functional integrated visible light photocatalyst for CO_2 reduction was prepared by combining homogeneous catalyst metalloporphyrin CoTDPP with the heterogeneous photosensitizer graphitic carbon nitride via covalent bonding. The strong interaction between catalyst unit and photosensitizer unit is conductive to the separation and migration of photogenerated charge carriers and the metalloporphyrin CoTDPP not only provides single site catalytic center but also effectively broadens the visible light absorption range of the functional integrated photocatalyst. The g-CNU-CoTDPP exhibited excellent photocatalytic performance for CO_2 reduction with CO as the major product at an average evolution rate of 57 μmol/(g·h) and the selectivity of 79% over competing H_2 evolution.



VSe_2 ultrafine nanocrystals immobilized on the nitrogen-doped graphene hybrid nanosheets (VSe_2 NC@NG) as a new polysulfides barrier are synthesized via a self-template strategy, which possess more exposed sulfiphilic planes of VSe_2, as well as benefit the uniform nucleation of Li_2S—making this system an excellent polysulfides barrier for lithium–sulfur batteries.

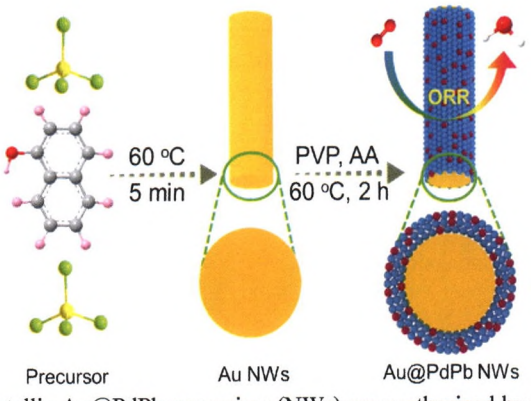


A Pt-MXene-TiO_2 composite exhibits highly efficient methanol oxidation reaction (MOR) performance with light irradiation via a photo-active cascaded electro-catalytic process.

Trimetallic Au@PdPb nanowires for oxygen reduction reaction

Xian Jiang[1,2,3], Yuexin Xiong[3], Ruopeng Zhao[2], Jiancheng Zhou[1,*], Jong-Min Lee[2,*], and Yawen Tang[3,*]

[1] Southeast University, China
[2] Nanyang Technological University, Singapore
[3] Nanjing Normal University, China

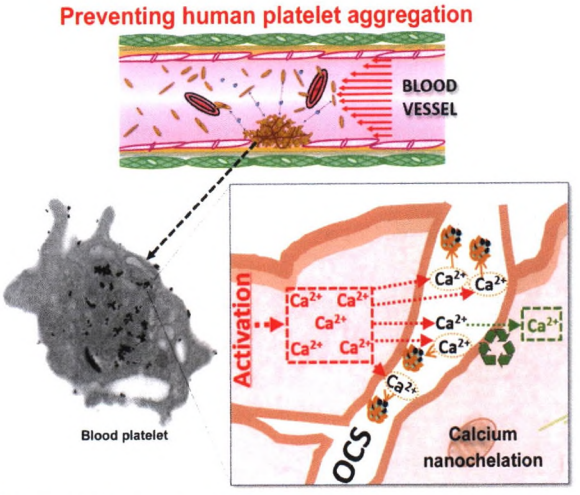


Trimetallic Au@PdPb nanowires (NWs) are synthesized by using pre-fabricated ultrathin Au nanowires as the one-dimensional template. The Au@PdPb NWs are demonstrated to be active and stable for the oxygen reduction reaction (ORR), much better than those of commercial Pd black and bimetallic Au@Pd NWs. Considering facile synthesis method and excellent ORR performance, the developed Au@PdPb NWs may have great potential in the field of fuel cells.

Controlling human platelet activation with calcium-binding nanoparticles

David Cabrera[1], Karen Walker[1], Sandhya Moise[1,2], Neil D. Telling[1], and Alan G. S. Harper[1,*]

[1] Keele University, UK
[2] University of Bath, UK

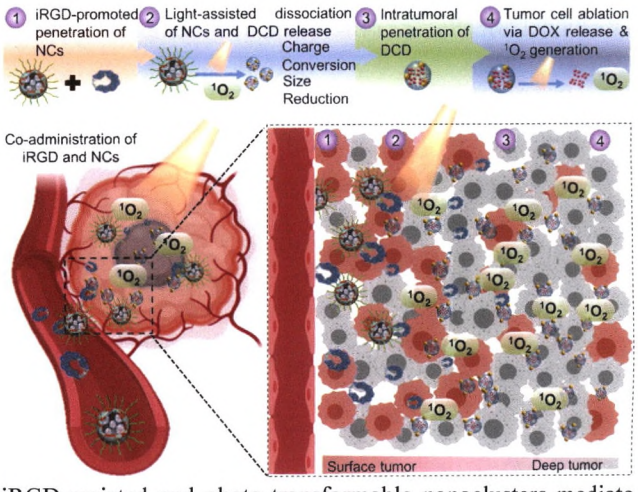


Calcium-binding magnetic nanoparticles are an effective anti-platelet nanomedicine. These nanoparticles function by chelating calcium in the open canalicular system (OCS; a space formed by the infolding of the platelet plasma membrane) interfering with normal Ca^{2+} signaling pathways that drive platelet aggregation.

iRGD-reinforced, photo-transformable nanoclusters toward cooperative enhancement of intratumoral penetration and antitumor efficacy

Jing Yan[1], Rongying Zhu[2], Fan Wu[1], Ziyin Zhao[1], Huan Ye[1], Mengying Hou[1], Yong Liu[1,*], and Lichen Yin[1,*]

[1] Soochow University, China
[2] The Second Affiliated Hospital of Soochow University, China

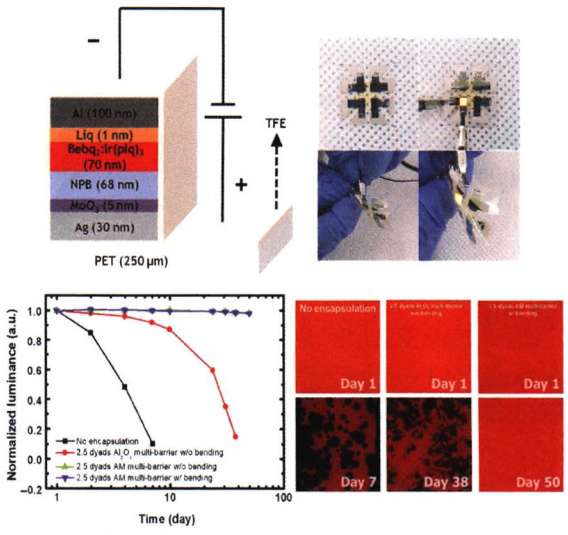


iRGD-assisted and photo-transformable nanoclusters mediate cooperative enhancement of intratumoral penetration and programmed tumor ablation.

Reliable high temperature, high humidity flexible thin film encapsulation using Al_2O_3/MgO nanolaminates for flexible OLEDs

Ki Suk Kang[1], So Yeong Jeong[1], Eun Gyo Jeong[2,*], and Kyung Cheol Choi[1,*]

[1] Korea Advanced Institute of Science and Technology (KAIST), Republic of Korea
[2] Chonnam National University, Republic of Korea

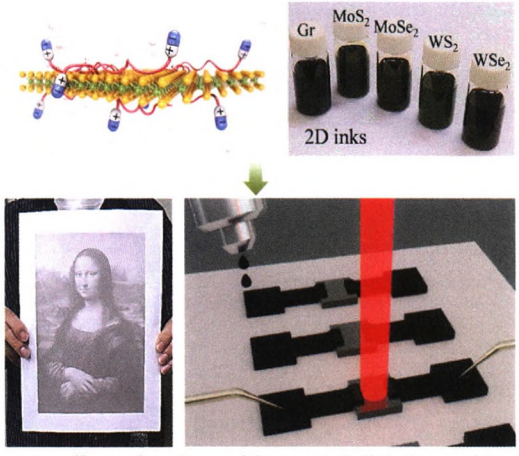


An Al_2O_3/MgO nanolaminate was fabricated and it exhibited greatly improved hydrolysis resistance in harsh environmental conditions than Al_2O_3. An actual encapsulated operating device was tested under bending stress and the device demonstrated excellently stable shelf-lifetime in a harsh environment.

Zwitterion-assisted transition metal dichalcogenide nanosheets for scalable and biocompatible inkjet printing

Hyeokjung Lee, Min Koo, Chanho Park, Madhumita Patel, Hyowon Han, Tae Hyun Park, Pawan Kumar, Won-Gun Koh, and Cheolmin Park*

Yonsei University, Republic of Korea

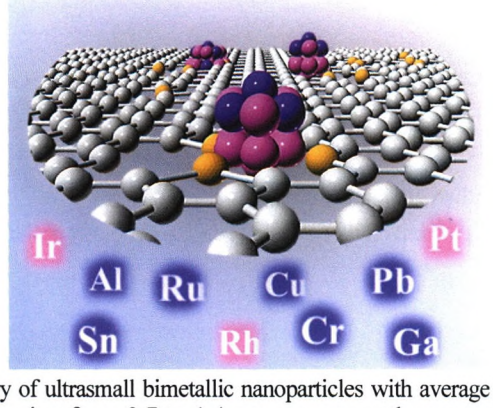


Various two-dimensional transition metal dichalcogenide (TMD) nanosheets, in addition to few-layered graphene, are inkjet-printed using a novel liquid-phase exfoliation process based on zwitterionic dispersants in water. Aqueous, biocompatible zwitterionic inks with TMD nanosheets are suitable for conventional office inkjet printing, giving rise to the mechanically flexible, printed arrays of two-terminal, parallel type photodetectors with pixelated TMD channels.

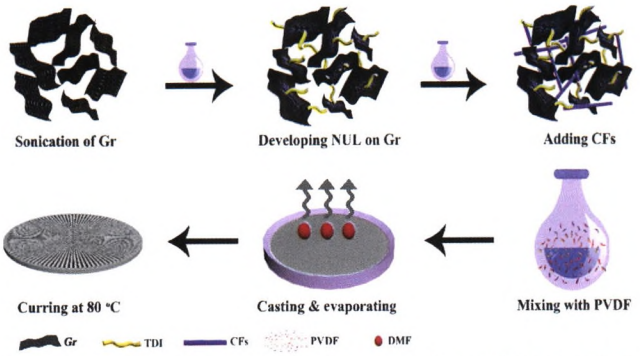
A library of carbon-supported ultrasmall bimetallic nanoparticles

Shi-Long Xu[1], Shan-Cheng Shen[1], Ze-Yue Wei[1], Shuai Zhao[1], Lu-Jie Zuo[1], Ming-Xi Chen[1], Lei Wang[1], Yan-Wei Ding[1], Ping Chen[2], Sheng-Qi Chu[3], Yue Lin[1,*], Kun Qian[1,*], and Hai-Wei Liang[1,*]

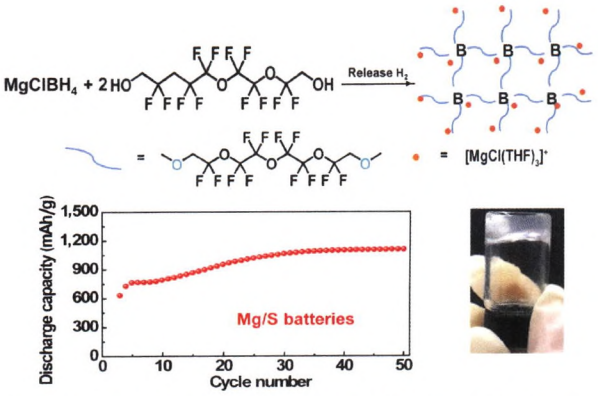
[1] University of Science and Technology of China, China
[2] Anhui University, China
[3] Institute of High Energy Physics, Chinese Academy of Sciences, China



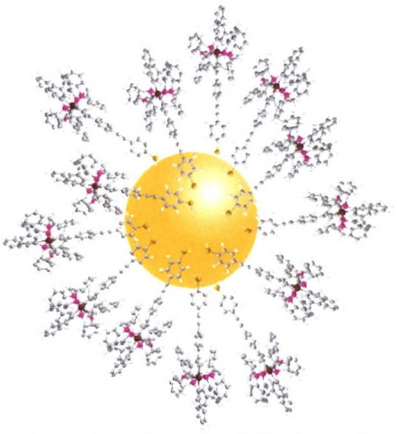
A library of ultrasmall bimetallic nanoparticles with average particle sizes ranging from 0.7 to 1.4 nm are prepared on mesoporous sulfur-doped carbon supports. The synthetic approach is based on the strong chemical interaction between the doped sulfur atoms on carbons and metals, which suppresses the metal aggregation during H_2-reduction and ensures the formation of small-sized and alloyed bimetallic nanoparticles.



The nanourethane linkage (NUL) based graphene (Gr) and carbon fibers (CFs) 3D architecture (NUL-Gr/CFs) is fabricated, which is further employed in making composite of polyvinylidene fluoride (PVDF). Herein, toluene diisocyanate (TDI) is utilized to develop NUL.



Gel-type electrolytes are advantageous in terms of safety and flexibility compared with liquid electrolytes. Here, a non-nucleophilic gel-type magnesium chloride-(fluorinated tetraethylene glycolic)borate (MgCl-FTGB) electrolyte is synthesized. Mg deposition and stripping can be conducted with high rate and low overpotential in this electrolyte. It is also compatible with S cathode and enables stable cycling of Mg/S batteries.

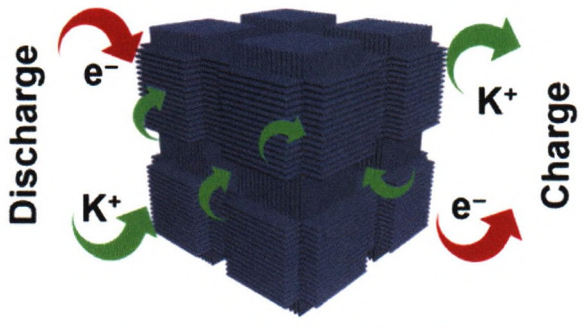


Oligo(p-phenyleneethynylene)s (OPEs) end-capped with (alkynyl)bis(diphosphine)ruthenium and thiol/thiolate groups stabilize ca. 2 nm diameter gold nanoparticles (AuNPs) affording OPE/AuNP hybrids that display long-term stability in solution (more than a month), good solubility in organic solvents, reversible ruthenium-centered oxidation, and transparency beyond 800 nm, and possess very strong nonlinear absorption activity at the first biological window, and unprecedented two-photon absorption activity in the second biological window (σ_2 up to 38,000 GM at 1,050 nm).

Edge-enriched MoS_2 for kinetics-enhanced potassium storage

Guangshen Jiang[1], Xiaosa Xu[1], Haojie Han[1], Changzhen Qu[1], Hlib Repich[1], Fei Xu[1,2,*], and Hongqiang Wang[1,*]

[1] Northwestern Polytechnical University, China
[2] Technische Universität Dresden, Germany

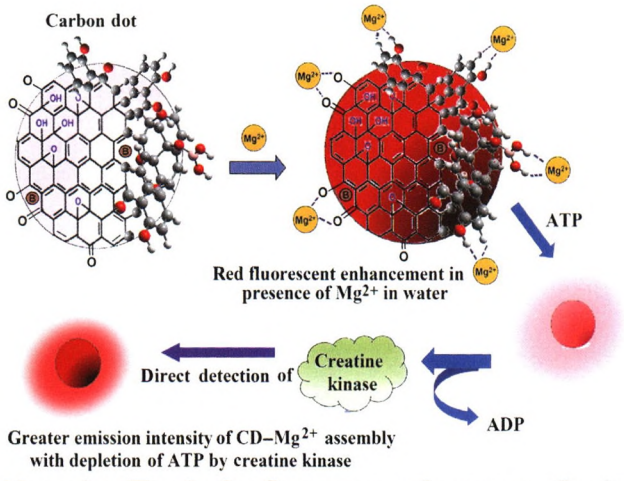


Edge-enriched MoS_2 (EE-MoS_2) was designed with bicontinuous mesoscale skeletons and mesopores, rendering its intrinsic layer spacing more accessible for K^+ and accelerating conversion kinetics, thus realizing enhanced capacity and high rate capability.

Amplified fluorescence of Mg^{2+} selective red-light emitting carbon dot in water and direct evaluation of creatine kinase activity

Saptarshi Mandal, Jagannath Pal, Ranga Subramanian, and Prolay Das*

Indian Institute of Technology Patna, India

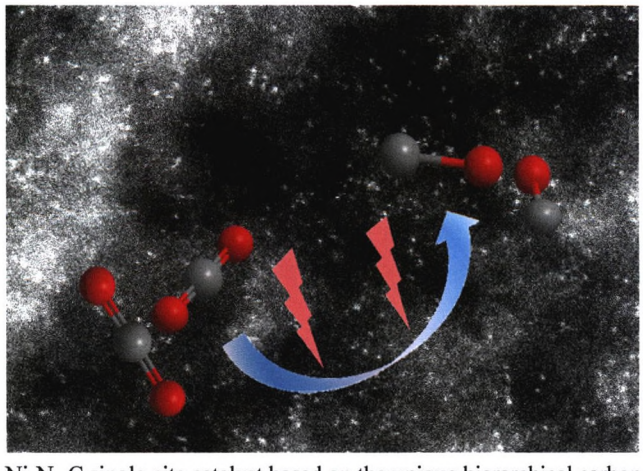


Magnesium(II) selective fluorescence enhancement of carbon dot was applied to the direct detection of creatine kinase.

Advanced Ni-N_x-C single-site catalysts for CO_2 electroreduction to CO based on hierarchical carbon nanocages and S-doping

Yiqun Chen[1], Yuejian Yao[1], Yujian Xia[2], Kun Mao[1], Gongao Tang[1], Qiang Wu[1,*], Lijun Yang[1,*], Xizhang Wang[1], Xuhui Sun[2], and Zheng Hu[1,*]

[1] Nanjing University, China
[2] Soochow University, China

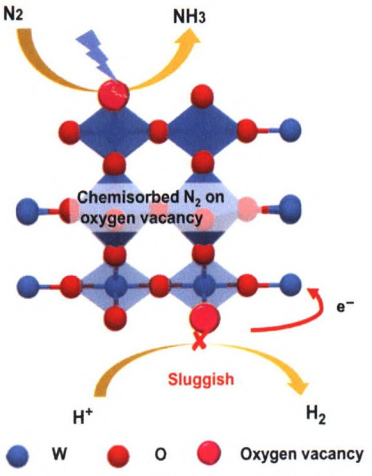


Ni-N_x-C single-site catalyst based on the unique hierarchical carbon nanocages exhibits a high plateau of Faradaic efficiency for CO_2 electroreduction to CO in a wide range of −0.6 to −1.0 V. S-doping further enhances the CO partial current by 68% and the Faradaic efficiency to 95% at −0.8 V.

Regulating surface state of WO_3 nanosheets by gamma irradiation for suppressing hydrogen evolution reaction in electrochemical N_2 fixation

Yanqiu Du, Cheng Jiang, Li Song, Bin Gao, Hao Gong, Wei Xia, Lei Sheng, Tao Wang*, and Jianping He*

Nanjing University of Aeronautics and Astronautics, China

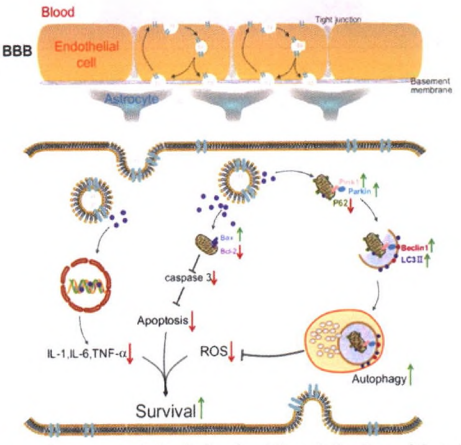


The WO_3 nanosheets with oxygen vacancy were designed for nitrogen reduction reaction (NRR) and tuned electroinc state to suppress hydrogen evolution reaction (HER).

The enhanced protective effects of salvianic acid A: A functionalized nanoparticles against ischemic stroke through increasing the permeability of the blood-brain barrier

Yaru Li[1,2], Xiaojie Zhang[1], Zhifeng Qi[3,*], Xueling Guo[1,2], Xiaopeng Liu[4], Wenjuan Shi[3], Yang Liu[1,2,*], and Libo Du[1,2,*]

[1] Institute of Chemistry, Chinese Academy of Sciences, China
[2] Graduate School, University of Chinese Academy of Sciences, China
[3] Xuanwu Hospital of Captital Medical University, China
[4] The Second Hospital of Hebei Medical University, China

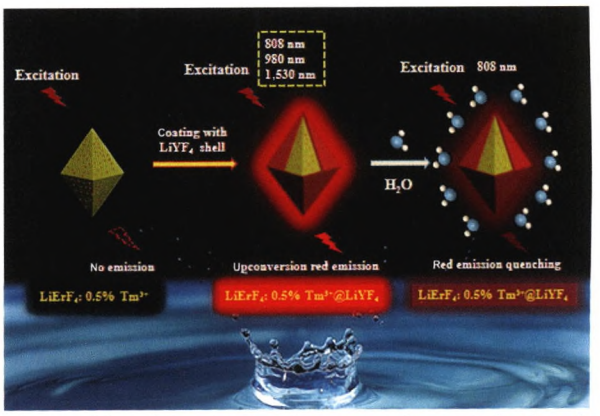


A new type of nanoparticle linked with salvianic acid A (SA) and modified with a targeting peptide, COG1410, that targets the lipoprotein receptors (LPR) on the surface of vascular endothelial cells is fabricated. The potential mechanism of action of the T-SA-NPs in damaged neurons as a result of ischemic stroke is proposed. The internalization of the T-SA-NPs allows the released SA to protect the cells from oxidative stress damage that is induced by ischemic stroke.

Construction of self-sensitized $LiErF_4$: 0.5% Tm^{3+}@$LiYF_4$ upconversion nanoprobe for trace water sensing

Ling Zhang[1], Xiaodan Li[1], Wang Wang[2], Xu Zhao[1], Xu Yan[1], Chenguang Wang[1], Haoqiang Bao[1], Yang Lu[1], Xianggui Kong[2], Fengmin Liu[1], Xiaomin Liu[1,*], and Geyu Lu[1,*]

[1] Jilin University, China
[2] Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Science, China

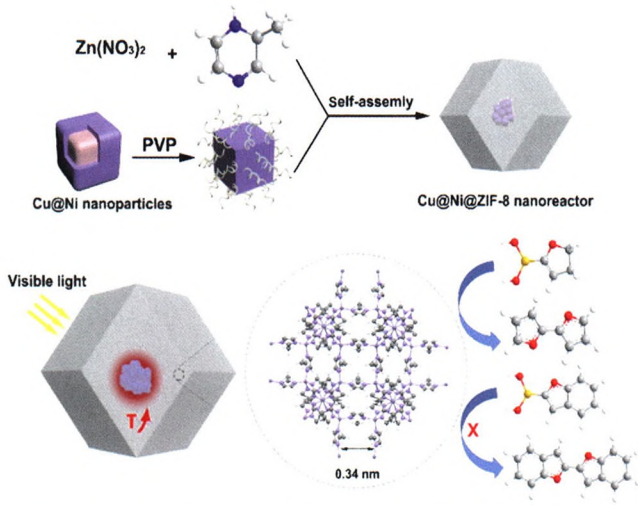


We have achieved the strong red upconversion emission based on $LiErF_4$ system, i.e., $LiErF_4$@$LiYF_4$ and its relevant derivative $LiErF_4$: 0.5% Tm^{3+}@$LiYF_4$, which exhibit strong monochromic red emission under multiband near-infrared (NIR) excitation (e.g., ~ 808, ~ 980 and ~ 1,530 nm). The Er^{3+} ions enriched nature makes $LiErF_4$: 0.5% Tm^{3+}@$LiYF_4$ nanoparticles very sensitive for trace water sensing with detection limit of 30 ppm in acetonitrile, 50 ppm in dimethyl sulfoxide (DMSO), and 58 ppm in N,N-dimethyl-formamide (DMF) under safe excitation of 808 nm.

Plasmonic coupling-enhanced *in situ* photothermal nanoreactor with shape selective catalysis for C–C coupling reaction

Zhenxing Li[1,*], Yixuan Gong[1], Xin Zhang[1], Yangyang Wen[1], Jiasai Yao[1], Mingliang Hu[1], Miao He[1], Jiahao Liu[1], Rui Li[1], Fuqiang Wang[2], and Chuanxin Zhang[2,*]

[1] China University of Petroleum (Beijing), China
[2] Harbin Institute of Technology at Weihai, China

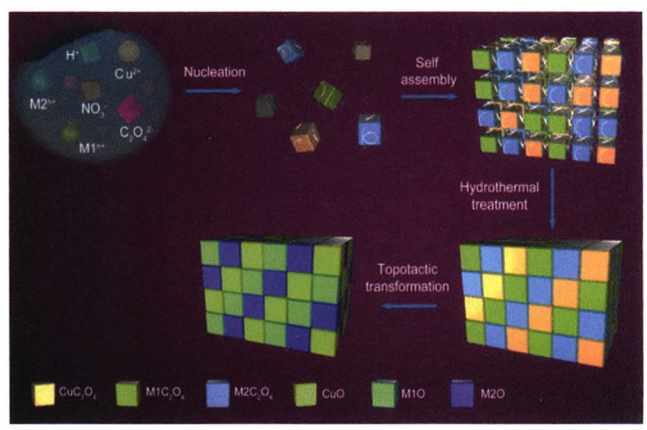


A multifunctional nanoreactor for C–C coupling reaction was successfully designed via encapsulating the core-shell Cu@Ni nanocubes into ZIF-8 (Cu@Ni@ZIF-8).

A general bottom-up synthesis of CuO-based trimetallic oxide mesocrystal superstructures for efficient catalytic production of trichlorosilane

Hezhi Liu[1,3], Yongjun Ji[2,1,*], Jing Li[1], Yu Zhang[1], Xueguang Wang[3], Haijun Yu[4], Dingsheng Wang[5], Ziyi Zhong[6,7], Lin Gu[8], Guangwen Xu[9], Yadong Li[5], and Fabing Su[1,9,10,*]

[1] Institute of Process Engineering, Chinese Academy of Sciences, China
[2] Beijing Technology and Business University, China
[3] Shanghai University, China
[4] Beijing University of Technology, China
[5] Tsinghua University, China
[6] Guangdong Technion–Israel Institute of Technology (GTIIT), China
[7] Technion–Israel Institute of Technology (IIT), Israel
[8] Institute of Physics, Chinese Academy of Sciences, China
[9] Shenyang University of Chemical Technology, China
[10] Zhongke Langfang Institute of Process Engineering, China

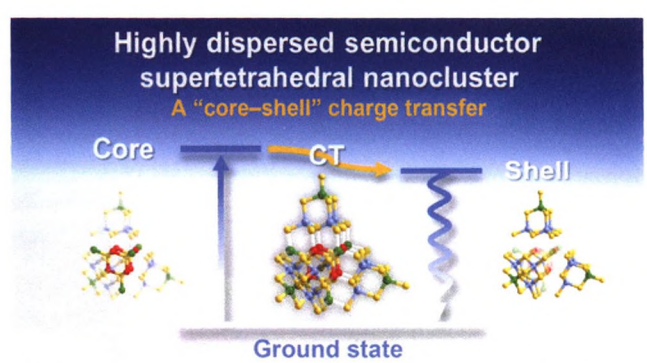


A general bottom-up synthesis of CuO-based trimetallic oxide mesocrystals (denoted as CuO-$M1O_x$-$M2O_y$, where M1 and M2 = Zn, In, Fe, Ni, Mn, and Co) is reported using a simple precipitation method followed by a hydrothermal treatment and a topotactic transformation via calcination.

Atomically precise metal-chalcogenide semiconductor molecular nanoclusters with high dispersibility: Designed synthesis and intracluster photocarrier dynamics

Jiaxu Zhang[1], Chaochao Qin[2], Yeshuang Zhong[3], Xiang Wang[1], Wei Wang[1,3], Dandan Hu[1], Xiaoshuang Liu[1], Chaozhuang Xue[1], Rui Zhou[1], Lei Shen[4], Yinglin Song[1], Dingguo Xu[3], Zhien Lin[3], Jun Guo[1], Haifeng Su[4], Dong-Sheng Li[5], and Tao Wu[1,*]

[1] Soochow University, China
[2] Henan Normal University, China
[3] Sichuan University, China
[4] Xiamen University, China
[5] China Three Gorges University, China

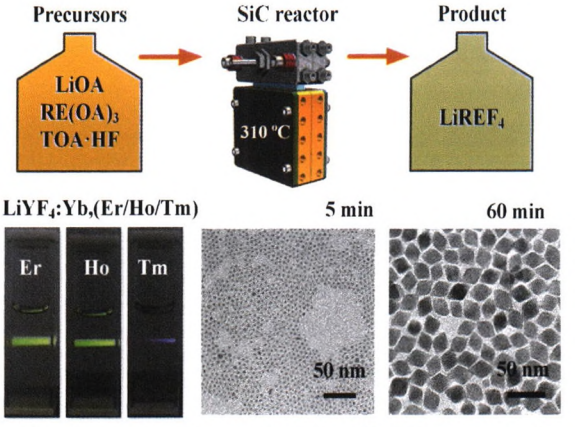


A unique "core–shell" charge transfer relaxation dynamics directed by composition variation was observed in a group of atomically precise semiconductor nanoclusters with targeted high dispersibility in solution.

Efficient synthesis of lithium rare-earth tetrafluoride nanocrystals via a continuous flow method

Jinsong Sui, Junyu Yan, Kai Wang*, and Guangsheng Luo

Tsinghua University, China

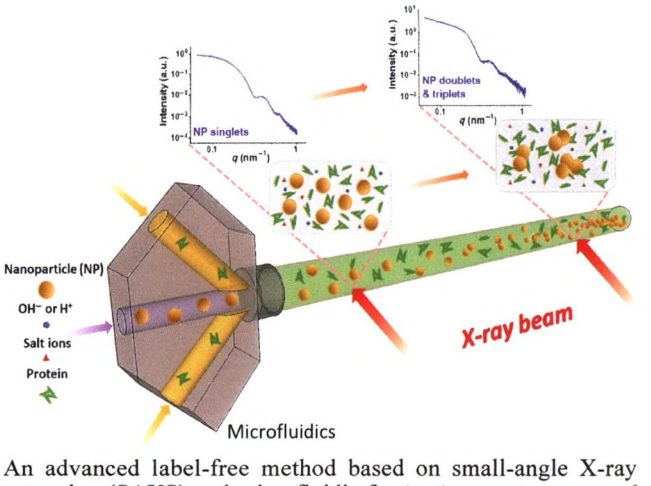


A continuous method for synthesizing $LiREF_4$ nanocrystals was developed with the assistant of a new precursor solution and a silicon carbide (SiC) reactor. The new precursor solution employed trioctylamine (TOA) as the solvent, which prevented the generation of unnecessary solid components, and the space-time yield of the continuous method is about 15 times of that traditional batch reactions.

New approach for time-resolved and dynamic investigations on nanoparticles agglomeration

Neda Iranpour Anaraki[1,2], Amin Sadeghpour[1], Kamran Iranshahi[1,3], Claudio Toncelli[1], Urszula Cendrowska[4], Francesco Stellacci[4], Alex Dommann[1,5], Peter Wick[2], and Antonia Neels[1,2,*]

[1] Swiss Federal Laboratories for Materials Science and Technology, Switzerland
[2] University of Fribourg, Switzerland
[3] Swiss Federal Institute of Technology, Switzerland
[4] EPFL, Switzerland,
[5] University of Bern, Switzerland

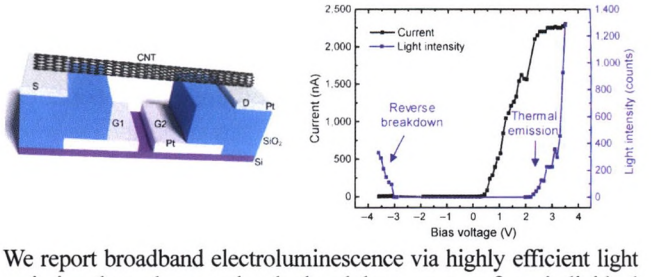


An advanced label-free method based on small-angle X-ray scattering (SAXS) and microfluidic for *in situ* measurements of dynamic processes, namely nanoparticles agglomeration in biological media is reported.

Broadband electroluminescence from reverse breakdown in individual suspended carbon nanotube pn-junctions

Bo Wang[1], Sisi Yang[1], Yu Wang[1], Younghee Kim[2], Ragib Ahsan[1], Rehan Kapadia[1], Stephen K. Doorn[2], Han Htoon[2], and Stephen B. Cronin[1,*]

[1] University of Southern California, Los Angeles, USA
[2] Los Alamos National Laboratory, USA

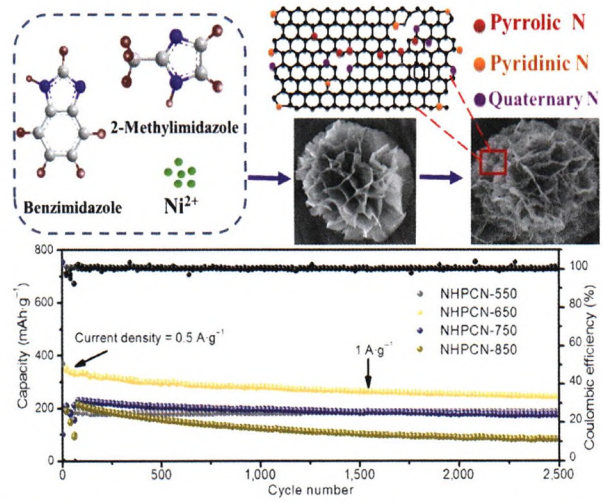


We report broadband electroluminescence via highly efficient light emission through an avalanche breakdown process from individual suspended carbon nanotube (CNT) dual-gate field effect transistor (FET) devices. The corresponding spectra obtained via thermal emission are considerably narrower than those obtained under reverse breakdown.

High N-doped hierarchical porous carbon networks with expanded interlayers for efficient sodium storage

Dongqin Su[1], Man Huang[1], Junhao Zhang[1,*], Xingmei Guo[1], Jiale Chen[1], Yanchun Xue[1], Aihua Yuan[1,*], and Qinghong Kong[2]

[1] Jiangsu University of Science and Technology, China
[2] Jiangsu University, China

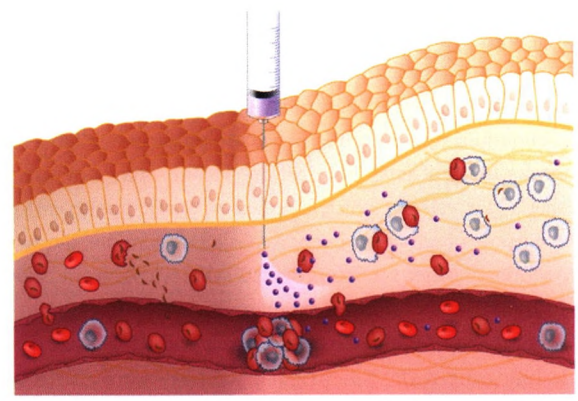


A novel self-template strategy is designed to synthesize uniform flowerlike N-doped hierarchical porous carbon networks (NHPCN) with high content of N (15.31 at.%), expanded interlayer spacing, ultrathin two-dimensional nano-sized subunits, and three-dimensional porous network structure, delivering outstanding sodium storage performances.

Neglected interstitial space in malaria recurrence and treatment

Qiang Zhang[1,2], Zhuo Ao[1,2,*], Nan Hu[1,3], Yuting Zhu[1], Fulong Liao[1,4], and Dong Han[1,2,*]

[1] National Center for Nanoscience and Technology, China
[2] University of Chinese Academy of Sciences, China
[3] Chengde Medical University, China
[4] China Academy of Chinese Medical Sciences, China

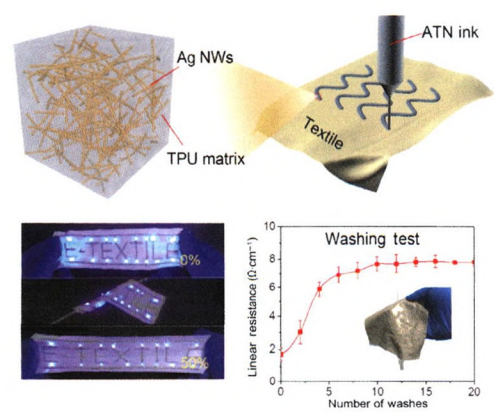


The interstitial space plays an important role that cannot be ignored in the recurrence and treatment of malaria, and may provide a potential way to prevent and treat infectious diseases.

Printable elastic silver nanowire-based conductor for washable electronic textiles

Hong-Wu Zhu, Huai-Ling Gao, Hao-Yu Zhao, Jin Ge, Bi-Cheng Hu, Jin Huang, and Shu-Hong Yu*

University of Science and Technology of China, China



Printable elastic conductor with conductivity of 3,668 $S \cdot cm^{-1}$ was developed for electronic textiles (e-textiles). One-step printing of ink could fabricate robust e-textiles, which could endure repeated stretching, folding, and machine washing.

Erratum to: Cobalt phosphide nanoarrays with crystalline-amorphous hybrid phase for hydrogen production in universal-pH (https://doi.org/10.1007/s12274-020-2881-y)

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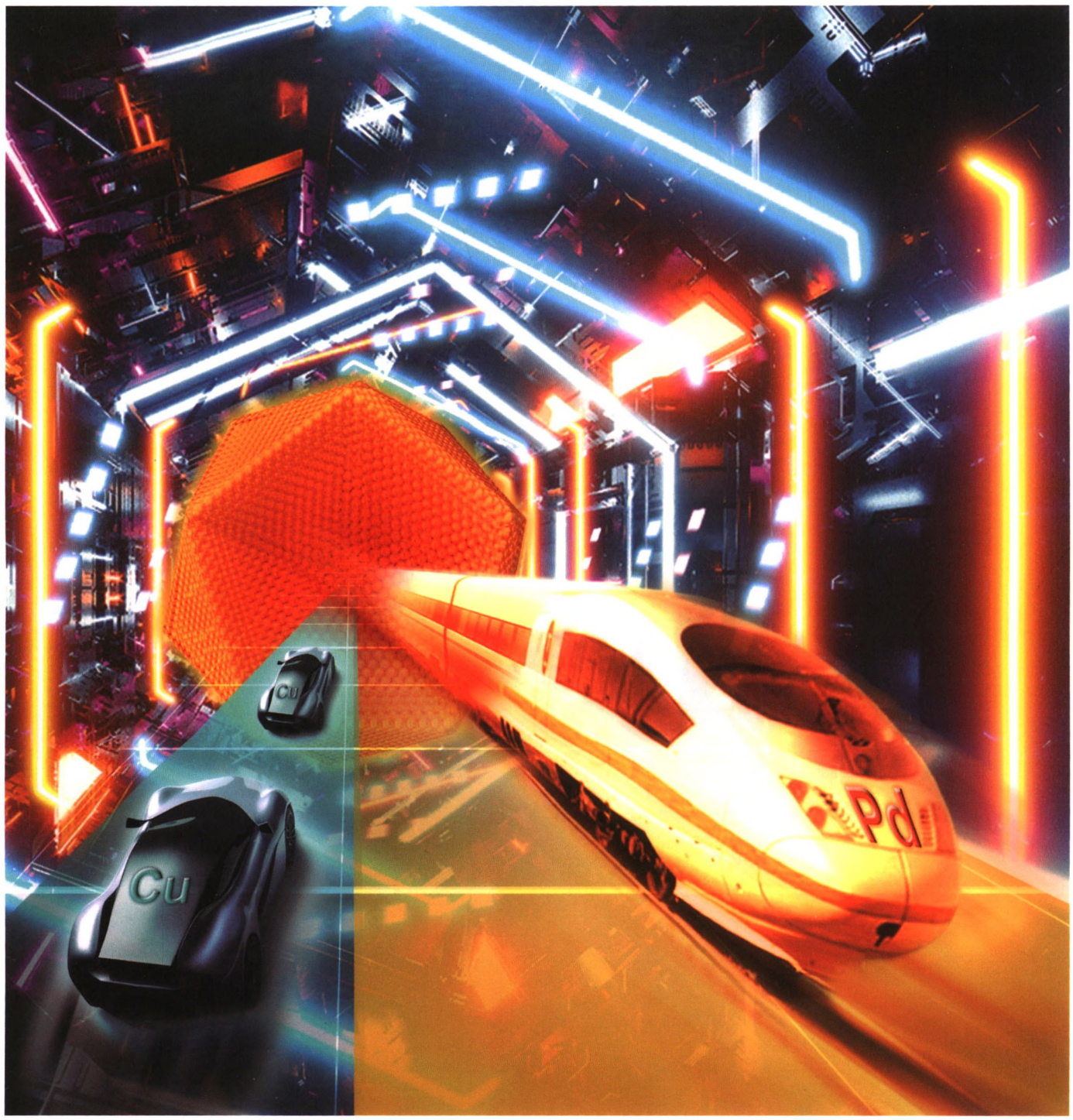

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