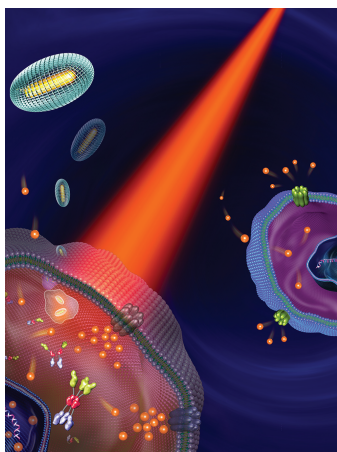


ADVANCED FUNCTIONAL MATERIALS

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Cancer Treatment

On page 4229, X. Wu, C. Chen, and co-workers discuss a simple strategy to combat cancer drug resistance using plasmonic-based photothermal properties. A localized mild photothermal stimulus can modulate the drug-resistance-related genes and thus enhance drug sensitivity and accumulation in resistant breast cancer cells. The integrated nanoplatform combining photothermal therapy with chemotherapy promises to inhibit a wide range of resistances.

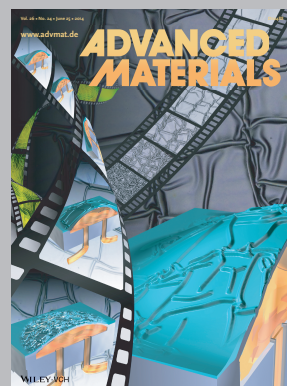
Memory

Memory behavior using the maltoheptaose-*block*-polystyrene electret is manipulated via morphological transfer from random spheres to vertical and horizontal cylinders by R. Borsali, W.-C. Chen, and co-workers. On page 4240, the supramolecule MH(APy) electret further enhances the hole-trapping capability with the excellent characteristics of a wide memory window (52.7 V), long retention time (over 104 s), with a high ON/OFF-current ratio (>105), and stable reversibility over 200 cycles without decay.



Donor–Acceptor Molecules

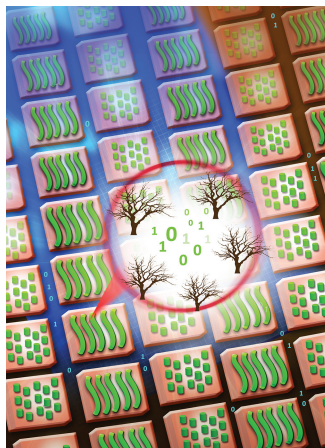
Z. T. Liu, G. X. Zhang, S.-X. Liu, D. Q. Zhang, and co-workers report a new cruciform donor–acceptor molecule, BDFTM, exhibiting both remarkable solid-state red emission and p-type semiconducting behavior. On page 4250, crystalline microrods and microplates of BDFTM show typical optical waveguiding behaviors with a rather low optical loss co-efficient. Notably, an organic field-effect transistor with a thin film of BDFTM is successfully utilized for the highly sensitive and selective detection of H₂S gas, down to ppb levels.



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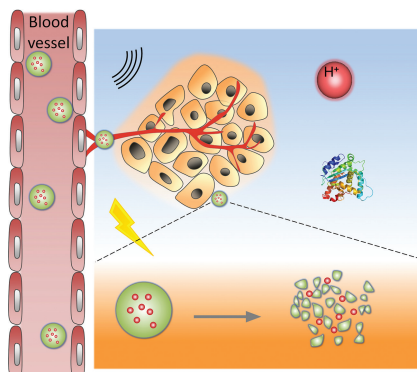
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FEATURE ARTICLE

Theranostics

Y. Wang, M. S. Shim, N. S. Levinson,
H.-W. Sung, Y. Xia* 4206–4220

Stimuli-Responsive Materials for Controlled Release of Theranostic Agents



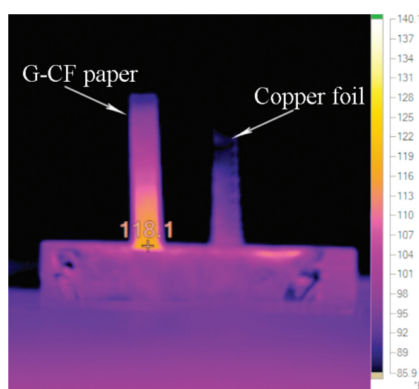
Stimuli-responsive carriers can respond to environmental variations and release theranostic cargos in a spatially and temporally controlled manner. The variations can be internal, such as physiological and pathological changes in the target cells/tissues, or caused by external means such as optical and ultrasound radiations.

FULL PAPERS

Graphene

Q.-Q. Kong, Z. Liu, J.-G. Gao,
C.-M. Chen,* Q. Zhang, G. M. Zhou,
Z.-C. Tao, X.-H. Zhang, M.-Z. Wang,
F. Li, R. Cai 4222–4228

Hierarchical Graphene–Carbon Fiber Composite Paper as a Flexible Lateral Heat Spreader

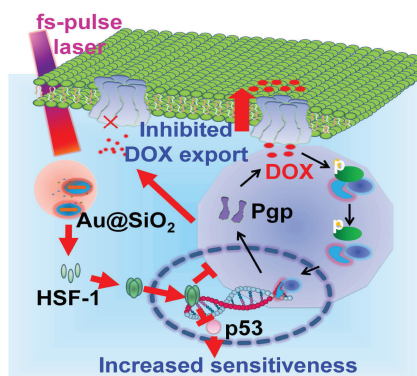


Flexible graphene–carbon fiber composite paper with an ultra-high thermal diffusivity of $5458 \text{ mm}^2 \text{ s}^{-1}$, a very large thermal conductivity of $977 \text{ W m}^{-1} \text{ K}^{-1}$, and a tensile strength of 15.3 MPa is fabricated through facile filtration route, in which the close packed graphene nanosheets provide high thermal conductivity, while carbon fiber acts as the structural scaffold to render excellent mechanical properties.

Cancer Treatment

L. Wang, X. Lin, J. Wang, Z. Hu, Y. Ji,
S. Hou, Y. Zhao, X. Wu,*
C. Chen* 4229–4239

Novel Insights into Combating Cancer Chemotherapy Resistance Using a Plasmonic Nanocarrier: Enhancing Drug Sensitiveness and Accumulation Simultaneously with Localized Mild Photothermal Stimulus of Femtosecond Pulsed Laser

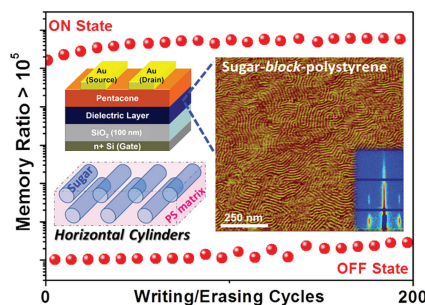


A novel strategy is developed to combat drug resistance using the plasmonic feature-based photothermal properties. Irradiation at a mild laser power density, this photothermal effect induces the heat shock factor (HSF-1) trimers and depresses the expression of Pgp and mutant p53 so significantly that both drug accumulation and their sensitiveness to drugs can be greatly enhanced.

Memory

Y.-C. Chiu, I. Otsuka, S. Halila,
R. Borsali,* W.-C. Chen* 4240–4249

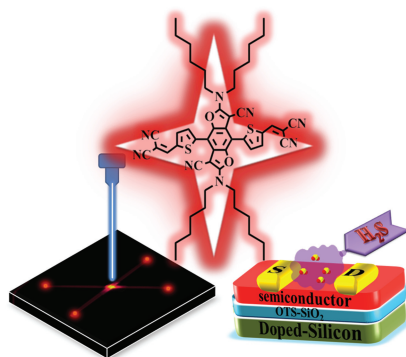
High-Performance Nonvolatile Transistor Memories of Pentacene Using the Green Electrets of Sugar-based Block Copolymers and Their Supramolecules



Sugar-based block copolymers, maltoheptaose-block-polystyrene (MH-b-PS), and their supramolecules are employed as electrets toward a high-performance organic field-effect transistor (OFET) memory, where the morphological transformation of polyhydroxylated MH cylinders surrounded by the PS matrix dominate the electrical switching characteristics of the OFET memory.

FULL PAPERS

A new cruciform D–A molecule (BDFTM) exhibiting both remarkable solid-state red emission and *p*-type semiconducting behavior is reported. Crystalline microrods and microplates of BDFTM show optical waveguiding behaviors with low optical loss coefficients. Thin films show air-stable *p*-type semiconducting. Notably, OFETs with thin films of BDFTM can be utilized for highly sensitive and selective detection of H₂S gas down to ppb levels.

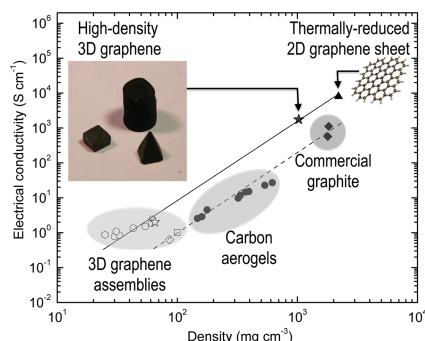


Donor–Acceptor Molecules

H. W. Luo, S. J. Chen, Z. T. Liu,*
C. Zhang, Z. X. Cai, X. Chen,
G. X. Zhang,* Y. S. Zhao, S. Decurtins,
S.-X. Liu,* D. Q. Zhang*4250–4258

A Cruciform Electron Donor–Acceptor Semiconductor with Solid-State Red Emission: 1D/2D Optical Waveguides and Highly Sensitive/Selective Detection of H₂S Gas

High-density, machinable, 3D graphene with properties approaching those observed in individual graphene sheets is presented. Synthesis relies upon sp² carbon cross-linking between partially restacked graphene sheets to achieve densities of $\approx 1 \text{ g cm}^{-3}$. The resulting material possesses electrical and mechanical properties 3–6 orders of magnitude higher than previously reported 3D graphene assemblies, and exceeds the properties of much denser commercial graphite.

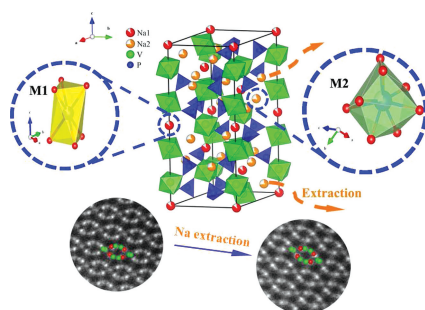


Graphene

M. A. Worsley,* S. Charnvanichborikarn,
E. Montalvo, S. J. Shin, E. D. Tylski,
J. P. Lewicki, A. J. Nelson,
J. H. Satcher Jr., J. Biener,
T. F. Baumann,
S. O. Kucheyev4259–4264

Toward Macroscale, Isotropic Carbons with Graphene-Sheet-Like Electrical and Mechanical Properties

Two different Na sites with different coordination environments co-exist in Na₃V₂(PO₄)₃. When Na is extracted from Na₃V₂(PO₄)₃, Na occupying the M2 site is extracted and the rest of the Na remains at M1 sites, meanwhile keeping the skeleton structure. Na⁺ ions at the M1 site in Na₃V₂(PO₄)₃ tend to remain immobilized, suggesting a direct M2*-to-M2 conduction pathway.

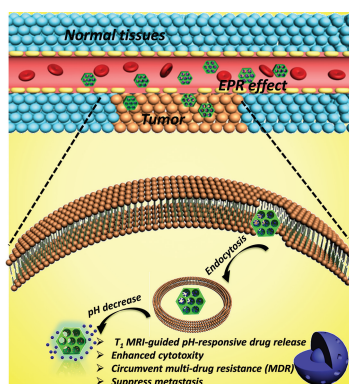


Cathodes

Z. L. Jian, C. C. Yuan, W. Z. Han,
X. Lu, L. Gu,* X. K. Xi,* Y.-S. Hu,*
H. Li, W. Chen, D. F. Chen, Y. Ikuhara,
L. Q. Chen4265–4272

Atomic Structure and Kinetics of NASICON Na_xV₂(PO₄)₃ Cathode for Sodium-Ion Batteries

A pH-responsive theranostic platform based on the ultrasmall iron oxide nanoparticles confined within a mesopore network is elaborately synthesized via a special physical-vapor-infiltration (PVI) method. The obtained materials exhibit a high T₁-weighted MRI performance and a pH-responsive drug-release feature for efficiently enhancing the treatment efficacy to circumvent multidrug resistance (MDR) and to suppress the metastasis of tumor cells both in vitro and in vivo.



Theranostics

M. Wu, Q. Meng, Y. Chen, P. Xu,
S. Zhang, Y. Li,* L. Zhang, M. Wang,
H. Yao, J. Shi*4273–4283

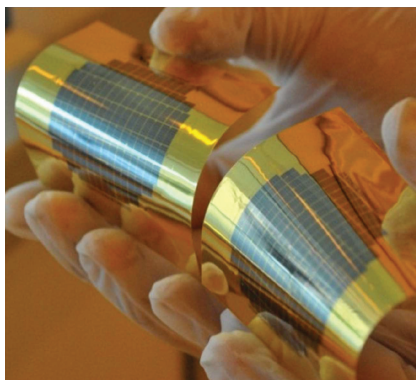
Ultrasmall Confined Iron Oxide Nanoparticle MSNs as a pH-Responsive Theranostic Platform

FULL PAPERS

Semiconductors

K. Lee, J. D. Zimmerman, T. W. Hughes,
S. R. Forrest* 4284–4291

Non-Destructive Wafer Recycling for Low-Cost Thin-Film Flexible Optoelectronics

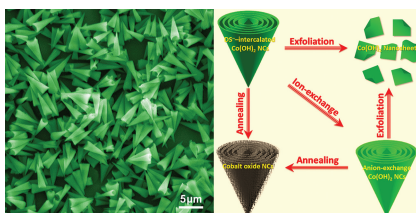


Non-destructive wafer recycling method for thin-film flexible optoelectronics is demonstrated by employing a combination of epitaxial lift-off, cold weld bonding, epitaxial protection layers and plasma cleaning techniques. The generality of the process is demonstrated by fabricating photovoltaic cells, light emitting diodes, and metal-semiconductor field effect transistors that are transferred onto flexible plastic substrates, and the parent wafer is recycled for regrowth.

Nanocoines

X. H. Liu, R. Ma,* Y. Bando,
T. Sasaki 4292–4302

High-Yield Preparation, Versatile Structural Modification, and Properties of Layered Cobalt Hydroxide Nanocoines



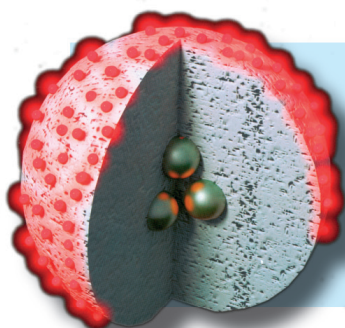
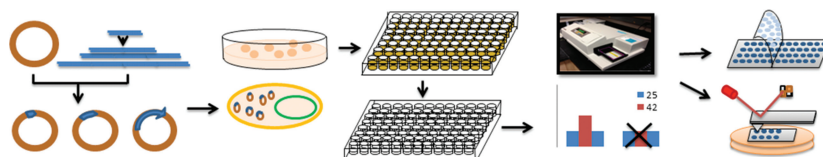
A new synthetic strategy is demonstrated for high-yield preparation of layered cobalt hydroxide nanocoines (NCs) under mild conditions. A new exfoliating procedure is also developed to obtain unilamellar nanosheets by gradually unravelling these NCs. These hydroxide NCs can be modified with various inorganic/organic anions or calcined into corresponding oxides, anticipating new opportunities for fundamental research, as well as technological applications in various fields.

Protein Polymers

Q. Wang, X. Xia, W. Huang, Y. Lin,
Q. Xu, D. L. Kaplan* 4303–4310

High Throughput Screening of Dynamic Silk-Elastin-Like Protein Biomaterials

A combinational library with high throughput screening is established for the synthesis and selection of dynamic silk-elastin-like protein (SELP) materials. Using this approach, 64 different SELPs with different material functions are selected, and new understanding of sequence-function relationships is gained. This study can provide a guide to future SELP library designs, and can be expanded for library construction of other protein materials.



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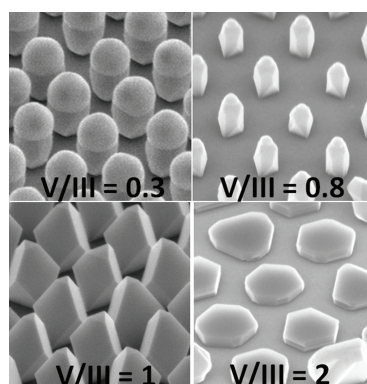
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FULL PAPERS

The morphology of Au-free InSb nanocrystals is extremely sensitive to growth conditions. By controlling the V/III ratio during growth, different InSb nanostructures can be achieved. Using low V/III growth conditions, In droplets start to form and InSb nucleation takes place at the droplet–semiconductor interface only, resulting in vertical, self-catalyzed InSb nanopillars.

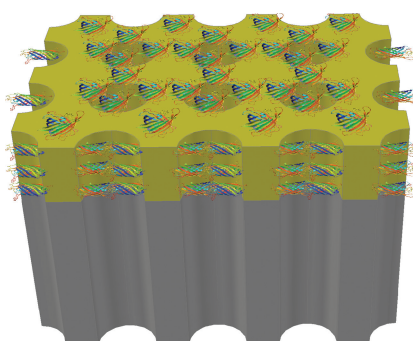


Nanoparticles

A. Lin,* J. N. Shapiro, H. Eisele,
D. L. Huffaker*4311–4316

Tuning the Au-Free InSb Nanocrystal Morphologies Grown by Patterned Metal–Organic Chemical Vapor Deposition

A dynamic electrochemical membrane system with nanometer-scale thick electrodes, mimicking the function of cell wall transporters, is reported for continuous affinity protein separation. The system is able to actively capture the affinity protein onto the pore entrance to block other proteins in a sequential/hopping manner, allowing selective transport.

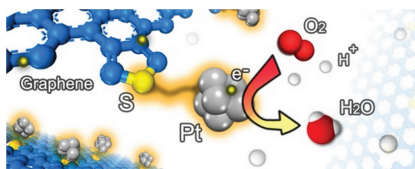


Biomimetics

Z. Chen, T. Chen, X. Sun,
B. J. Hinds*4317–4323

Dynamic Electrochemical Membranes for Continuous Affinity Protein Separation

Platinum supported on sulfur doped graphene (Pt/SG) is found to provide excellent oxygen reduction activity and stability. Experimental investigations indicate that utilizing SG as a support significantly improves the activity and stability of platinum nanoparticles in comparison to pure graphene, and commercial carbon supported platinum. Complementary computational simulations highlight the interactions between platinum and graphene are enhanced significantly by sulfur-doping.

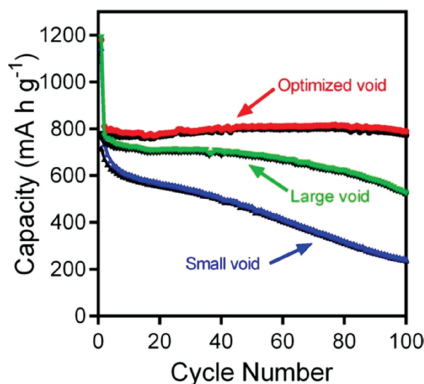


Electrochemistry

D. Higgins, M. A. Hoque, M. H. Seo,
R. Wang, F. Hassan, J.-Y. Choi,
M. Pritzker, A. Yu, J. Zhang,
Z. Chen*4325–4336

Development and Simulation of Sulfur-doped Graphene Supported Platinum with Exemplary Stability and Activity Towards Oxygen Reduction

Iron oxide@carbon yolk-shell structures with tunable void space are prepared and applied as anode materials for lithium ion batteries. The relationship between the size of void and the electrochemical performance is systematically studied. The results show that with an optimized void size, the iron oxide@carbon yolk-shell structure exhibits the best cycling stability.



Batteries

H. W. Zhang, L. Zhou,* O. Noonan,
D. J. Martin, A. K. Whittaker,
C. Z. Yu*4337–4342

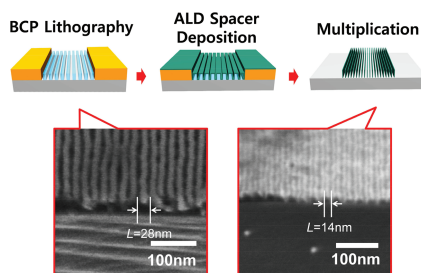
Tailoring the Void Size of Iron Oxide@Carbon Yolk–Shell Structure for Optimized Lithium Storage

FULL PAPERS

Pattern Multiplication

H.-S. Moon, J. Y. Kim, H. M. Jin,
W. J. Lee, H. J. Choi, J. H. Mun,
Y. J. Choi, S. K. Cha, S. H. Kwon,*
S. O. Kim* 4343–4348

**Atomic Layer Deposition Assisted
Pattern Multiplication of Block
Copolymer Lithography for 5 nm Scale
Nanopatterning**

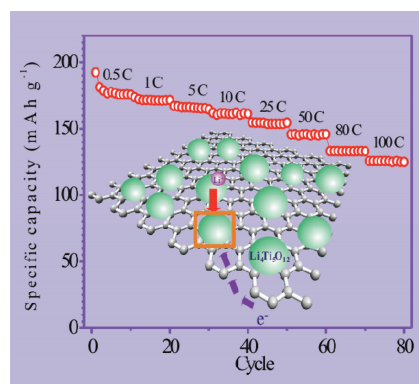


5-nm-scale line and hole patterning is achieved from low χ block copolymer (BCP) self-assembly synergistically integrated with atomic layer deposition (ALD) assisted pattern multiplication. This approach overcomes the intrinsic thermodynamic limitations of low χ BCPs for sub-10-nm scale downscaling, and eventually achieves a 200-fold enhancement of pattern density from 1 μm wide I-line topographic pattern into 5 nm patterns.

Graphene

Y. C. Yang, B. H. Qiao, X. M. Yang,
L. B. Fang, C. C. Pan, W. X. Song,
H. S. Hou, X. B. Ji* 4349–4356

**Lithium Titanate Tailored by Cathodically
Induced Graphene for an Ultrafast
Lithium Ion Battery**

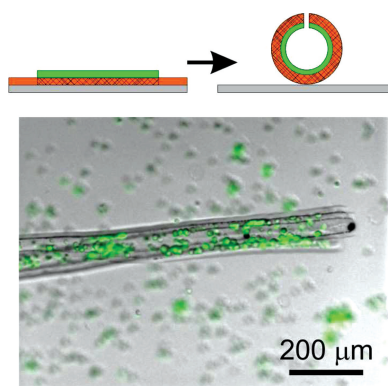


Defect-free cathodically induced graphene (CIG) is exploited to tailor the electrical conductivity and Li^+ diffusion coefficient of $\text{Li}_4\text{Ti}_5\text{O}_{12}$ (LTO) anode materials for lithium ion batteries. The as-tuned LTO/CIG exhibits excellent cycling stability (capacity retention ratio after 500 cycles at 0.5 C is 96.2%) and a remarkable rate capability (162 mAh g^{-1} at 10 C, 126 mAh g^{-1} at 100C).

Polymers

V. Stroganov, S. Zakharchenko,
E. Sperling, A. K. Meyer, O. G. Schmidt,
L. Ionov* 4357–4363

**Biodegradable Self-Folding Polymer
Films with Controlled Thermo-
Triggered Folding**

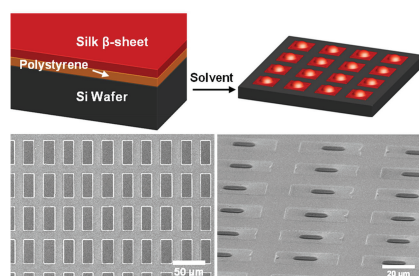


A simple and cheap approach for the fabrication of fully biodegradable and biocompatible self-rolled tubes, whose folding can be triggered by temperature, is developed. Depending on design, the films can either irreversibly fold at elevated temperature, or fold at room temperature and irreversibly unfold at elevated temperature. These films are suitable for the encapsulation of living cells.

Microcontainers

C. Ye, D. D. Kulkarni, H. Dai,
V. V. Tsukruk* 4364–4373

**Programmable Arrays of “Micro-Bubble”
Constructs via Self-Encapsulation**



A novel approach for fabricating self-formed highly ordered arrays of micro-bubble constructs from patterned silk microscopic sheets with self-encapsulation capability is established by confining frontal dissolution of a supporting sacrificial material and encapsulating the material underneath the ultrathin silk coating. The number, dimensions, and shape of the micro-bubbles can be readily controlled by the geometry of the silk sheets.