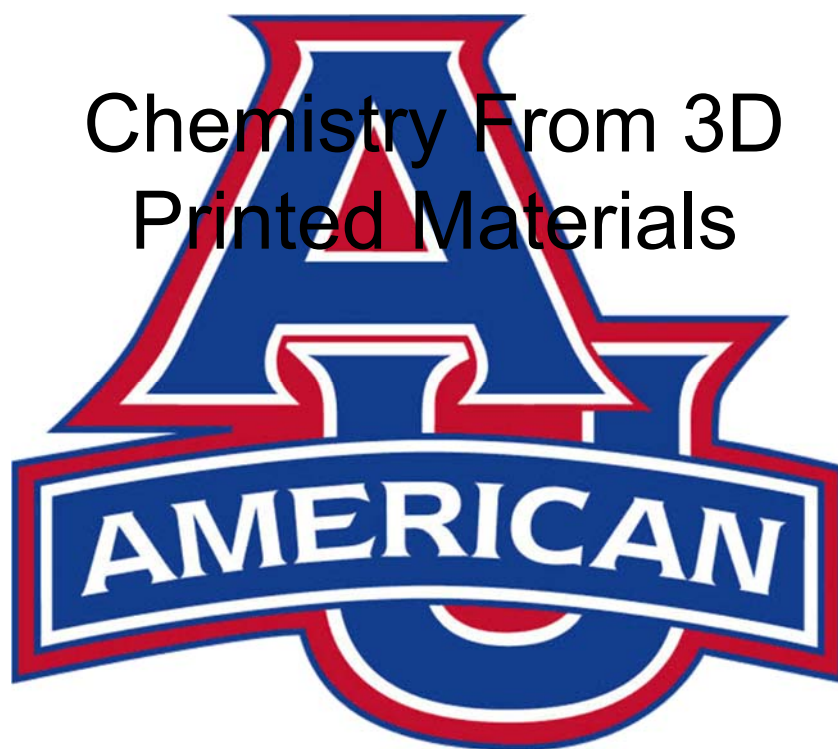


Chemistry From 3D Printed Materials



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Thank You!

Coworkers

Matthew S

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EMPA



Congratulations!



JAPAN PRIZE
2016 Laureate

Professor Hideo Hosono
Tokyo Institute of Technology, Japan



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Organic and soft materials (colloids, liquid crystals, gel, polymers)

The chemical, mechanical, and physical properties of 3D printed materials composed of TiO₂-ABS nanocomposites

Matthew R. Skorski, Jake M. Esenther, Zeeshan Ahmed, Abigail E. Miller & **Matthew R. Hartings** ✉

Pages 89-97 | Received 26 Nov 2015, Accepted 08 Feb 2016, Published online: 01 Apr 2016

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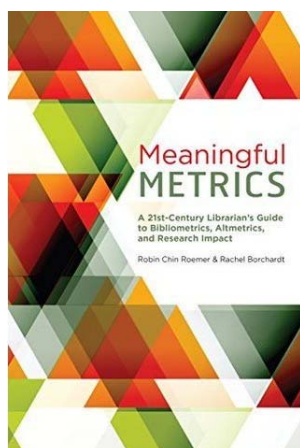
News (16)
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Communicating chemistry for public engagement

Matthew R. Hartings and Declan Fahy

The communication of chemistry to wider society is difficult because of 'chemophobia', its inherent complexity and its lack of unifying grand themes. To engage with citizens about the benefits and related dangers of the field, chemists must improve their dialogue with broader sections of the public — but how?

NATURE CHEMISTRY | VOL 3 | SEPTEMBER 20 11 | www.nature.com/naturechemistry



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April 5, 2016 — Larry Greenemeier



Help Stop TB

March 28, 2016 — Larry Greenemeier



Zooniverse: Jungle Rhythms

February 16, 2016 — Larry Greenemeier

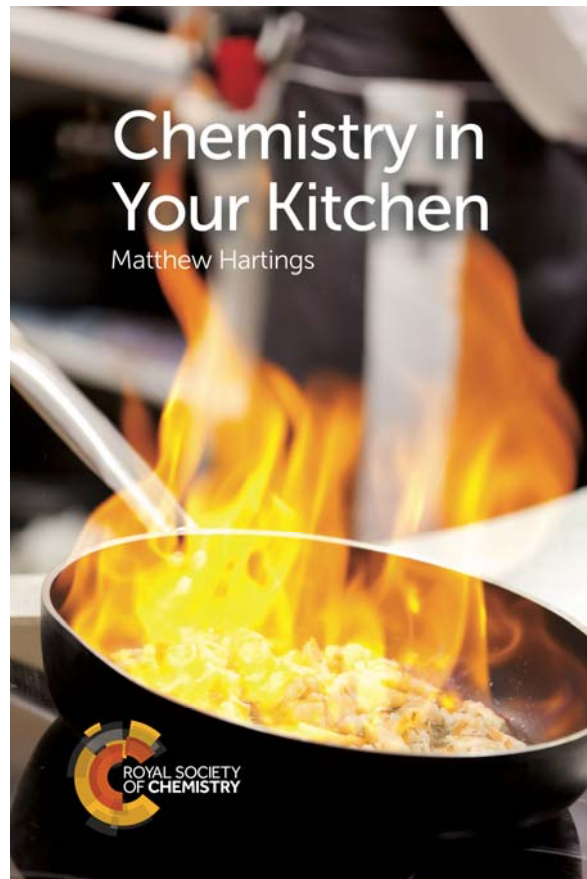


Wisconsin Wildlife Watch

January 12, 2016 — Larry Greenemeier



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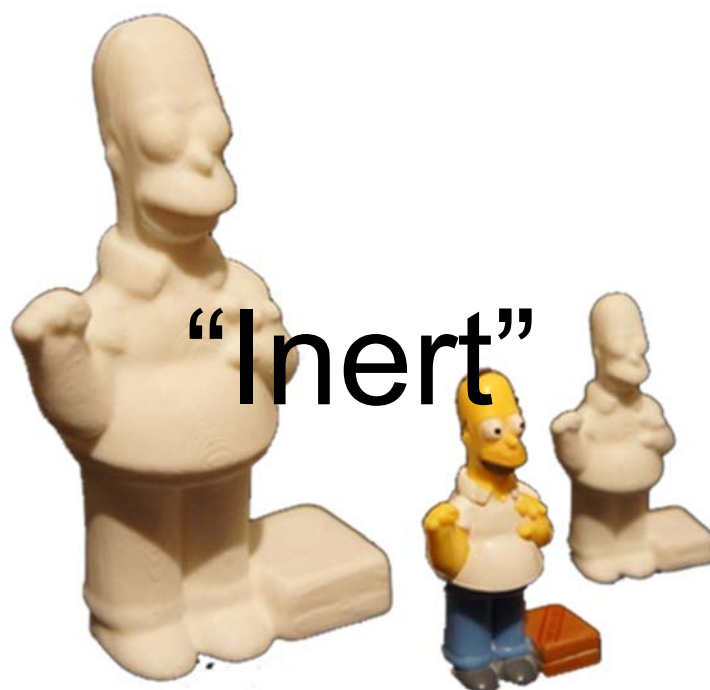


Can Print Any Shape You Want



[Image Source](#)

Chemically Uninteresting



[Image Source](#)

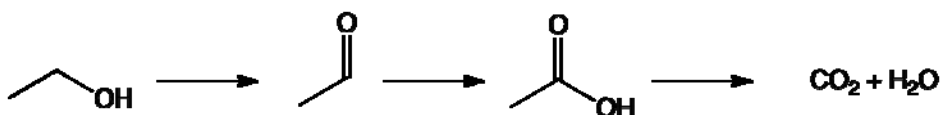
Printed Chemistry



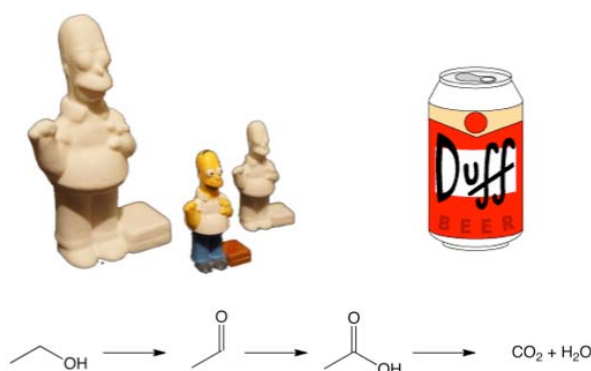
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Printed Chemistry



Incorporate the following into the print job:

- 1) Flow design to direct chemicals
- 2) Catalysts to facilitate chemical conversion

On Demand Chemistry From 3D Printed Materials



Chemical Reactivity comes from incorporated nanoparticles

Custom filaments made the same way as colored filaments

Printed shape dictated by application

Printed Chemistry

2) Catalysts to facilitate chemical conversion

SCIENCE AND TECHNOLOGY OF ADVANCED MATERIALS, 2016
VOL. 17, NO. 1, 89–97
<http://dx.doi.org/10.1080/14686996.2016.1152879>



 OPEN ACCESS

The chemical, mechanical, and physical properties of 3D printed materials composed of TiO_2 -ABS nanocomposites

Matthew R. Skorski^a, Jake M. Esenther^a, Zeeshan Ahmed^b, Abigail E. Miller^{a,c} and Matthew R. Hartings^a

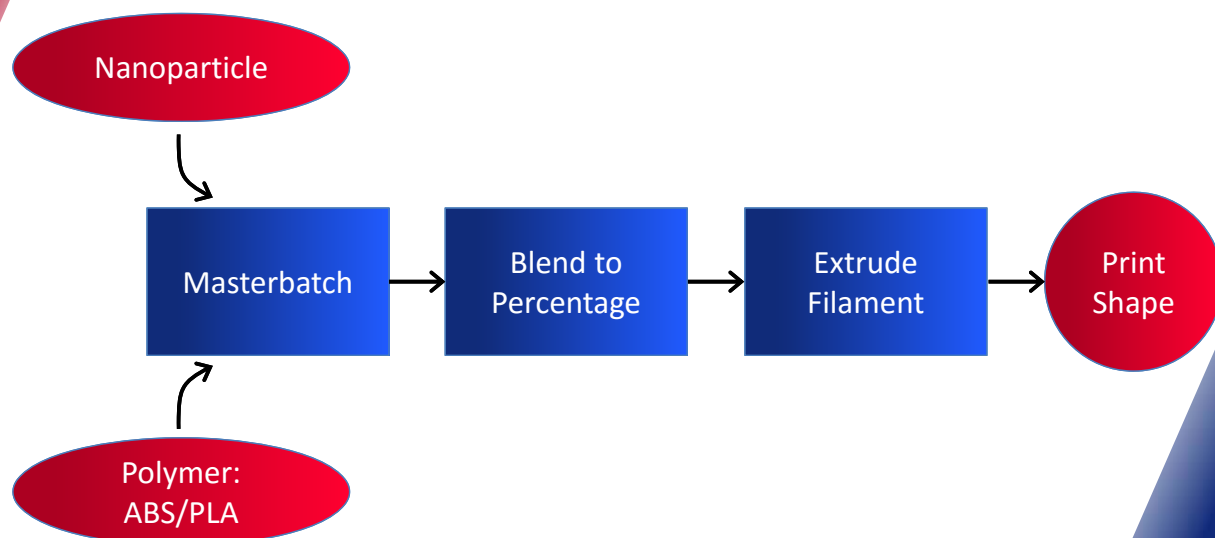
^aDepartment of Chemistry, American University, 4400 Massachusetts Ave., NW, Washington, DC, 20016, USA

^bThermodynamic Metrology Group, Sensor Science Division, Physical Measurement Laboratory, National Institute of Standards and Technology, Gaithersburg, MD 20899, USA

^cFood and Drug Administration, Washington, DC, USA

Printed Chemistry

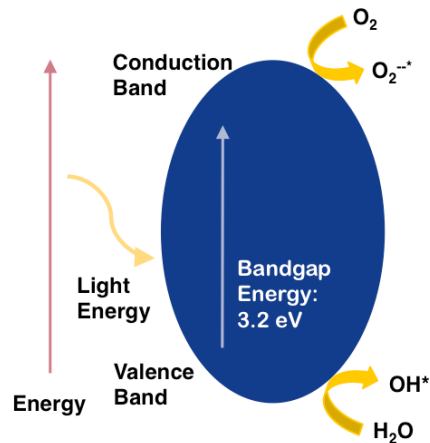
Incorporate nanoparticles the same way manufacturers incorporate dyes into 3D printing filaments



Printed Chemistry

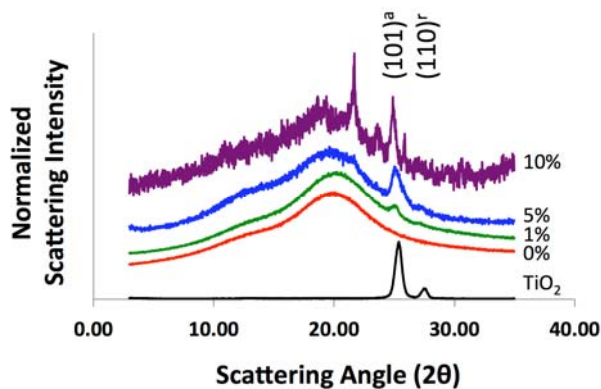
Why TiO_2 ?

- 1) Cheap
- 2) Abundant
- 3) Photoredox catalyst
(generates free radicals in aqueous environments when exposed to light)

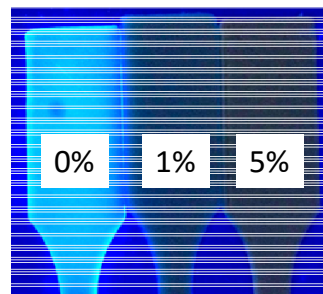


Printed Chemistry

The nanoparticles are not degraded in this process.



TiO_2 signals are present in the X-ray diffraction data



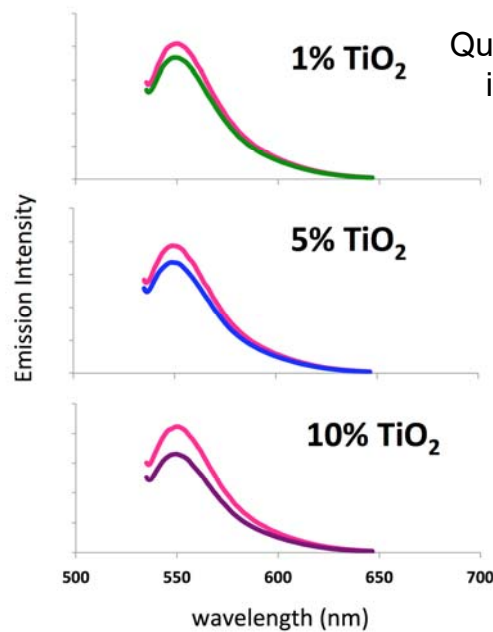
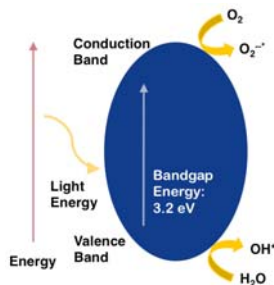
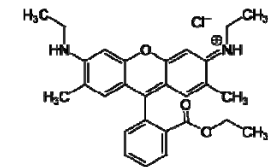
TiO_2 quenches the native fluorescence of ABS

Printed Chemistry

Is the TiO_2 still chemically active?

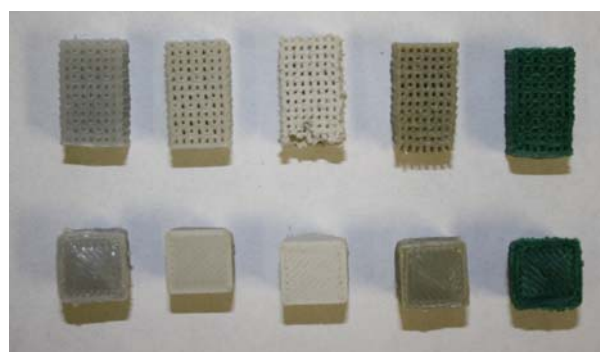
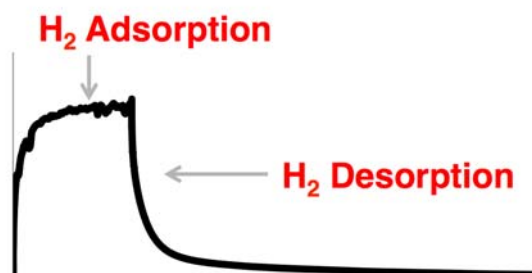
Does it interact with molecules in solution?

Exposure of a rhodamine 6G solution to sunlight in the presence and absence of a printed structure.



Quenched fluorescence:
interaction between
solution
and
nanoparticles

3D printed ABS-metal organic framework composite materials



Printed Chemistry

Outlook

Chemistry

Nanoparticle

Identity

Shape

Size

Surface Modification

Blending

Catalysis

Polymers

Composites

Processability

Chemistry

Reactivity

Orthogonality

Porosity

Print

Geometry Optimization

Printed Chemistry

Outlook

nature
chemistry

ARTICLES

PUBLISHED ONLINE: 15 APRIL 2012 | DOI: 10.1038/NCHEM.1313

Integrated 3D-printed reactionware for chemical synthesis and analysis

Mark D. Symes[†], Philip J. Kitson[†], Jun Yan[†], Craig J. Richmond[†], Geoffrey J. T. Cooper[†], Richard W. Bowman², Turlif Vilbrandt³ and Leroy Cronin^{1*}

NANO LETTERS

Letter

pubs.acs.org/NanoLett

3D Printed Bionic Ears

Manu S. Manno[†], Ziwen Jiang[†], Teena James[‡], Yong Lin Kong[†], Karen A. Malatesta[†], Winston O. Soboyejo[†], Naveen Verma[§], David H. Gracias[‡] and Michael C. McAlpine^{*,†}

Thank You!

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