

**FOR IMMEDIATE RELEASE  
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**MEDIA RELEASE [UPDATED]**

***IBN Scientists Discover New Method for the Facile Synthesis of a Wide Range of Nanoparticles with Multiple Functionalities***

**Institute of Bioengineering and Nanotechnology (IBN), Singapore** – Nanostructured materials have garnered great interest worldwide due to their unique size-dependent properties for chemical, electronic, structural, medical and consumer applications. IBN, the world's first bioengineering and nanotechnology research institute, has discovered a new environmentally friendly method to synthesize a wide variety of nanoparticles inexpensively. This new chemical synthesis has been recently published in the leading materials journal, *Nature Materials*, which has an impact factor of 23.132.<sup>1</sup>



Metals that dissolve in water are successfully extracted and transferred into a layer of toluene, an organic solvent that floats on water.

IBN researchers have developed a protocol to transfer metal ions from an aqueous solution to an organic solution such as toluene. Metal compounds that can dissolve in water are inexpensive and commonly available. Many useful metals and scarce materials that are soluble in water may now become readily employed in the synthesis of nanoparticles. This new approach developed by IBN is a simple, room-temperature process that does not produce toxic chemicals.

The research team at IBN has successfully transferred metal ions rapidly from water to an organic medium by mixing a solution of metal salts dissolved in water with an ethanol solution of dodecylamine (DDA). The metals would bond with the DDA and can then be extracted with an **organic solvent**. The transfer of the metal ions from the aqueous phase to the organic phase was successfully applied towards the synthesis of a variety of metallic, alloy and semiconductor nanoparticles. In contrast to other approaches for nanoparticles synthesis, the IBN protocol allows metal-based nanoparticles to be prepared in an organic medium using water-soluble, inexpensive, common metal precursors. This method is highly efficient and easily applied to derive many types of nanoparticles that have interesting applications, including metal-semiconductor nanocomposites and hybrid nanoparticles.

**Organic Solvent –**

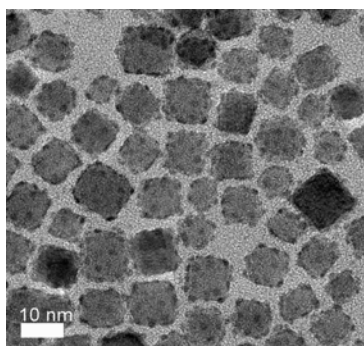
Organic solvents are chemical compounds that usually have a low boiling point, evaporate easily or can be removed by distillation. Solvents can be used to extract soluble chemical complexes from a mixture.

Besides IBN's focus on applying this protocol to the nanocrystalline synthesis of metals, semiconductors and their hybrids, the extraction of metals dissolved in water would be significant for applications in environmental remediation, e.g. extraction of heavy metals from water and soil. "Water pollution from heavy metals is a major long-term economic and healthcare problem that has global implications. Once contaminated, it is often difficult and expensive to purify the affected environment and extract the pollutants. Besides highly toxic metals such as mercury and lead, other valuable metals, including gold, silver, iridium and

osmium, are also soluble in water, and may be extracted by our protocol,” remarked Dr Jun Yang, IBN Research Scientist.

“We have demonstrated a general protocol for transferring metal ions from water to an organic phase. This technique may be applied to transfer a wide range of transition metal ions from water. We can greatly facilitate and reduce the cost of producing a variety of metallic, alloy, semiconductor and semiconductor-metal hybrid nanoparticles through our simple and flexible approach to engineer advanced materials with novel structures and multiple functionalities” said Professor Jackie Y. Ying, IBN Executive Director and principal investigator of this research.

**Image available on request:**



Transmission electron micrograph of heterogeneous lead sulfide-gold (PbS–Au) hybrid nanoparticles.

<sup>1</sup> Jun Yang<sup>a</sup>, Edward Sargent<sup>b</sup>, Shana Kelley<sup>b</sup> and Jackie Y. Ying<sup>a</sup>, “A General Phase-Transfer Protocol for Metal Ions and Its Application in Nanocrystal Synthesis,” *Nature Materials*, 8 (2009) 683-389. (Please refer to DOI 10.1038/NMAT2490)

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## About the Institute of Bioengineering and Nanotechnology

The Institute of Bioengineering and Nanotechnology (IBN) was established in 2003 as a national research institute under the Agency for Science, Technology and Research, Singapore, by Executive Director, Professor Jackie Yi-Ru Ying. Prof. Ying was a Professor of Chemical Engineering at the Massachusetts Institute of Technology (1992–2005). In 2008, Professor Ying was recognized as one of “One Hundred Engineers of the Modern Era” by the American Institute of Chemical Engineers for her groundbreaking work on nanostructured systems, nanoporous materials and host matrices for quantum dots and wires. Under her direction, IBN conducts research at the cutting-edge of bioengineering and nanotechnology. IBN’s research programs are geared towards linking multiple disciplines across engineering, science and medicine to produce research breakthroughs that will improve healthcare and our quality of life.

IBN’s research activities are focused in the following areas:

- **Drug and Gene Delivery**, where the controlled release of therapeutics involve the use of functionalized polymers, hydrogels and biologics for targeting diseased cells and organs, and for responding to specific biological stimuli.
- **Cell and Tissue Engineering**, where biomimicking materials, stem cell technology, microfluidic systems and bioimaging tools are combined to develop novel approaches to regenerative medicine and artificial organs.
- **Biosensors and Biodevices**, which involve nanotechnology and microfabricated platforms for high-throughput biomarkers screening, automated biologics synthesis, and rapid disease diagnosis.
- **Pharmaceuticals Synthesis and Nanobiotechnology**, which encompasses the efficient catalytic synthesis of chiral pharmaceuticals, and new nanocomposite materials for sustainable technology and alternative energy generation.

IBN's innovative research is aimed at creating new knowledge and intellectual properties in the emerging fields of bioengineering and nanotechnology to attract top-notch researchers and business partners to Singapore. Since 2003, IBN researchers have published a total of 502 papers. IBN also plays an active role in technology transfer and spinning off companies, linking the research institute and industrial partners to other global institutions. As of June 2009, IBN has filed 714 patent applications on its inventions and the Institute is currently looking for partners for collaboration and commercialization of its portfolio of technologies. IBN's current staff strength stands at ~ 180 scientists, engineers and medical doctors. With its multinational and multidisciplinary research staff, the institute is geared towards generating new biomaterials, devices, systems, equipment and processes to boost Singapore's economy in the fast-growing biomedical sector.

IBN is also committed to nurturing young minds, and the institute acts as a training ground for PhD students and undergraduates. In October 2003, IBN initiated a Youth Research Program to open its doors to university students, as well as students and teachers from various secondary schools and junior colleges. It has since reached out to more than 31,075 students and teachers from 205 local and overseas schools and institutions.

For more information, please log on to [www.ibn.a-star.edu.sg](http://www.ibn.a-star.edu.sg)

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