Synthesis Of Metal Oxide And Nitride Hollow Nano And Microspheres With Tunable Particle Size, Crystallinity, Porosity For Energy And Env. Applications

Tech ID: 32623 / UC Case 2018-555-0

FULL DESCRIPTION

Background

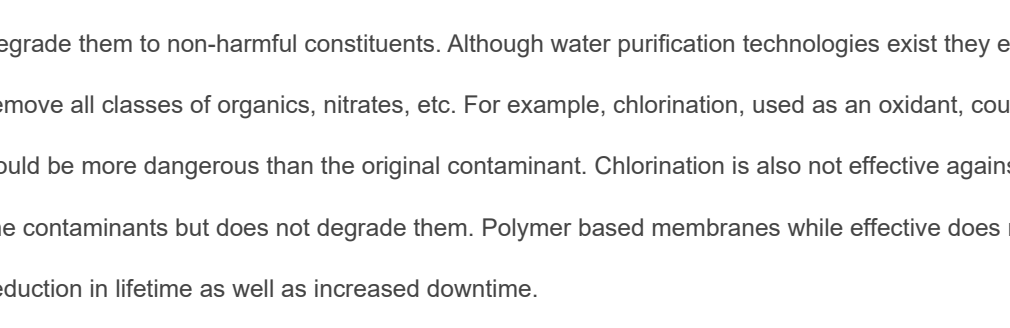
New water treatment technologies need to be developed that will not only remove contaminant compounds and industrial pollutants but degrade them to non-harmful constituents. Although water purification technologies exist they each have drawbacks including the inability to remove all classes of organics, nitrates, etc. For example, chlorination, used as an oxidant, could also produce chlorinated by-products that could be more dangerous than the original contaminant. Chlorination is also not effective against certain bacteria. Carbon is known to absorb the contaminants but does not degrade them. Polymer based membranes while effective does need significant maintenance thereby causing reduction in lifetime as well as increased downtime.

Photocatalysis provides an efficient path to oxidize organic compounds – the most common photocatalyst material being Titanium Dioxide (TiO_2). The challenges with TiO_2 are:

- Requires UV activation and therefore ineffective if sunlight is used as the UV source.
- TiO_2 has lower surface area limiting the efficiency of radical formation.

Current Invention

Prof. David Kisailus and his team have developed a novel, high surface area photocatalyst – Tantalum Nitride(Ta_3N_5) hollow nano or microspheres. The associated process enables the formation of tunable sized, high surface area that consist of oriented nanoparticles on the periphery of the spheres.



Schematic illustration of the two-step synthesis of Ta_3N_5 hollow nanospheres

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OTHER INFORMATION

KEYWORDS

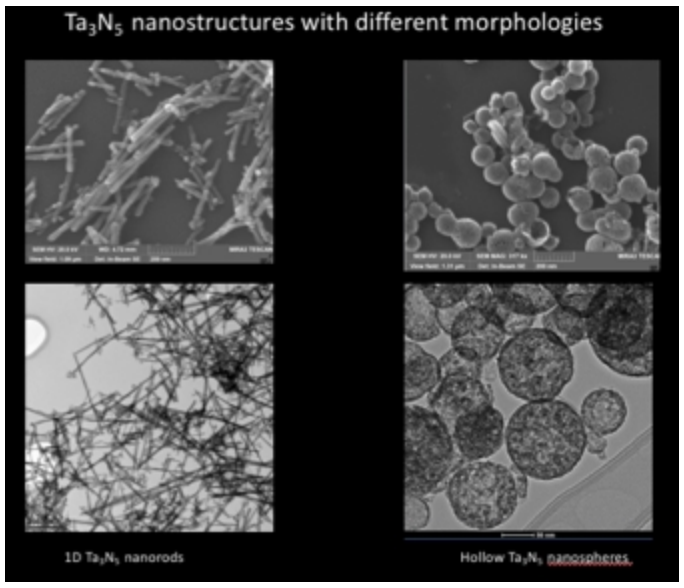
Nanoparticles, Tantalum Nitride, Ta3N5, Photocatalysis, Water purification, Hydrogen generation, Water splitting

CATEGORIZED AS

- **Energy**
  - Hydrogen
  - Solar
- **Environment**
  - Remediation
- **Engineering**
  - Engineering
- **Materials & Chemicals**
  - Chemicals
  - Nanomaterials
- **Nanotechnology**
  - Materials
- **Agriculture & Animal Science**
  - Chemicals

RELATED CASES

2018-555-0



Ta3N5 nanostructures with different morphologies including nanorods.

ADVANTAGES

The significant benefits of this patent pending technology are:

- Solution based highly scalable process that consumes less energy.
- The materials can also be doped with other cations or anions.
- The primary particles can be tuned to control their mechanical and chemical stability as well as their catalytic activity.
- Incorporating crystalline carbon into the spheres will improve the formation rate of radical species.
- Allows for 3D printing of larger hierarchically derived structures.

SUGGESTED USES

- Water purification
- Catalyze the formation of hydrogen from water.

RELATED MATERIALS

- Template-free synthesis of Ta3N5 hollow nanospheres as a visible-light-driven photocatalyst

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,623,211	04/11/2023	2018-555

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