Skysong Innovations
Advancing the Arizona State University Knowledge Enterprise

1475 N. Scottsdale Road, Suite 200
Scottsdale, AZ 85287-3538
Phone: 480 884 1996 Fax: 480 884 1984

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## Inventors

**Bin Mu**

**Bohan Shan**

## Contact

Shen Yan
shen.yan@skysonginnovations.com

# A Photo-Responsive Zirconium Metal-Organic Framework with Tun-able Optical Band Gap Energy and Ultrahigh Hydrostability

Smart metal-organic frameworks (MOFs) are porous, crystalline materials made of metals bonded to organic molecules (ligands) that have changeable properties when introduced to external stimuli. Changing the minimum energy required to excite an electron into a conductive state (optical band gap energy) allows control of the conductivity. Most efforts to control MOF properties center on varying the ligands, but doing so makes the structure instable when exposed to water. Instead, using external stimuli results in better control of the material's properties, though the caveat of the material's lack of hydrostability remains. Therefore, scientists now look toward integrating a robust material into the MOF as a solution to the structural instability.

Researchers at ASU have developed ZrPDA, a Zirconium-based MOF that is hydrostable and tunable in terms of optical band gap energy. ZrPDA maintains its crystal lattice structure underwater for at least 672 hours, making it extremely hydrostable. Additionally, the synthesized material is tunable with the capability to vary optical band gap energy. Moreover, ZrPDA retains ultrahigh specific surface area, a desirable feature for gas storage. Overall, ZrPDA's unique synthesis and sturdy structure solve the lack of hydrostability and range-of-use, offering greater range of functionality at a lower cost.

Potential Applications

- Photocatalysis
- Hybrid Semiconductors
- Energy Harvesting
- Gas Storage and Purification
- Sensors

Benefits and Advantages

- Lower Cost and Greater Range of Functionality – Allows use of a singular MOF to generate different desired properties
- Hydrostable – Maintains structure underwater for at least 672 hours, comparatively higher than other MOFs
- Photo-tunable – The structure allows for in-situ tuning of bandgap through UV irradiation

For more information about the inventor(s) and their research, please see:

Dr. Bin Mu's directory webpage