

## Eco-friendly method to produce designer metal-organic frameworks for low cost sensors.

Metal-organic frameworks (MOFs) are advanced materials made from metal ions connected by organic linker molecules. MOFs can be designed from different metals and linkers to target specific end-use applications.

Commercially attractive applications are light emitting or luminescent MOFs (LMOFs) powered sensors for Volatile Organic Compounds (VOC), biomarkers and photonic devices.

Current production of MOFs is not eco-friendly. It is currently a long complex process using toxic solvents (N,N-dimethylformamide, methanol) in *harsh* high temperature and pressure environments.

### Green and up-scalable production

Researchers at the University of Oxford have developed a fast method of producing large amounts MOF material. This uniquely eco-friendly method uses water as a solvent and allows processing at room temperature and pressure. The method has been applied to produce a specially designed MOF- a highly emissive silver metal based LMOF, invented and named as OX-2 by Oxford.

The resultant silver based LMOF detects changes in temperature and pressure, and functions as the electroluminescent layer of a LED device without toxic and expensive rare-earth elements.

This is a high-yield method to produce 10-g of high-quality silver-based LMOFs in under an hour, using cost-effective and environmentally friendly water solutions of silver nitrate and terephthalic acid. The estimated cost is about 1000 times cheaper than commercially produced MOFs, an advantage of processing in ambient conditions and employing water as solvent.

### The technology

When subjected pressure (up to 0.3 GPa) and temperature (up to 200°C), the Oxford silver based LMOF shows a dramatic decrease of the luminescence response. Its linearly reversible and reproducible thermo-chromic response is attractive for use in applications such as a *luminescent thermometer* and its mechanochromic response to pressure is promising for use as a luminescent *surface stress sensor*.

An Oxford MOF prototype LED device integrating OX-2 as the electroluminescent layer has been designed and fabricated (see image on the right).

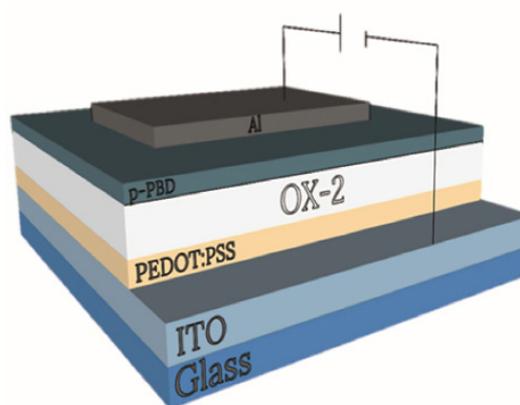
### Commercial advantages of the Oxford technology:

- Eco-friendly, fast, high-yielding, cost-effective, and patent protected production methodology
- Oxford OX-2 class of silver-based LMOF gives high luminescent quantum yield (60% in powder form) with long-term stability
- Devices with OX-2 provides linear, repeatable, and reproducible thermo-chromic response in luminescent thermometers
- Devices with OX-2 provides luminescent response to nominal stress deformation-based sensors
- Devices with OX-2 provides electroluminescent properties fabrication of LEDs which are free of toxic and expensive rare-earth elements

### Commercialisation

Oxford University Innovation Ltd. has filed a patent covering this technology and is now seeking an appropriate commercialisation partner.

Support is available to prospective commercialisation partners. Oxford researchers are advancing development of processing techniques for newly discovered target MOFs. A proof of concept programme is underway to design and develop a prototype VOC sensor suitable for industrial toxic VOC detection and diabetes diagnostics in healthcare.



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## Technology Transfer from the University of Oxford

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