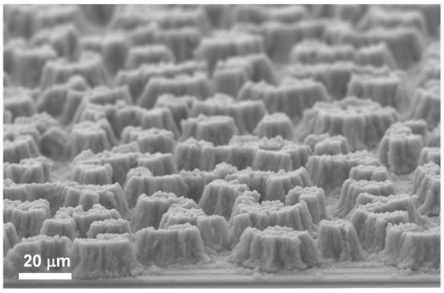
MQ COMMERCIALISATION

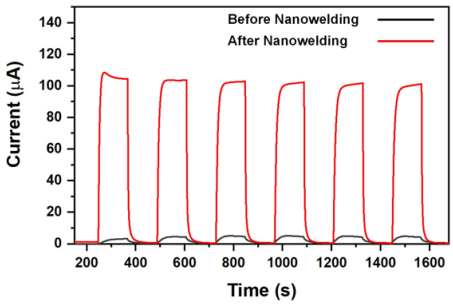
MACQUARIE University

# CAPILLARY FORCED INDUCED NANOWELDING IN METAL OXIDE 3D NANOSTRUCTURES

## BACKGROUND

3D nanostructures have been used as transparent conductors, wearable sensors and electronic nanodevices thanks in part to their unique and exceptional opto-electronic properties. However, to fully realise the exceptional performance of these nanostructures, efficient charge transport must be facilitated between the individual constituents. Typically, fabrication methods tend to produce poorly bonded morphologies, held only by weak Van der Waals forces, leaving nanoscale gaps that inhibit charge transport, and result in detrimental mechanical fragility and poor electrical conductivity. This is caused by the transduction of chemoelectric surface response at the interparticle grain boundaries – a mechanism we have yet to understand. High temperatures of 250–500 °C have been used to increase metal-oxide conductivity, providing sufficient energy for surface sensing reactions. But high operating temperature results in high power consumption, presenting a roadblock to integration of these nanostructures into real-world applications. In addition, such high temperature is not application for nonelectric devices with ultrathin electrodes and flexible (polymer based) substrates.




## OUR SOLUTION

Our solution involves the replacement of these weak contacts with strong primary bonds, through room temperature mass diffusion and nanowelding, offering superior mechanical and electronic properties. Instead of using high temperature treatment, we propose using capillary-force-driven methodology to enhance nanoparticle cohesion and to improve the electrical conductivity of nanostructured metal-oxide gas sensors. The key is the capacity of capillary forces as a significant driving force for self-assembly of nanoparticle agglomerates in a fractal nanostructured network, and its performance as a mechanism to enhance the conductivity of such nanostructures.

## APPLICATIONS

- ✓ Printable Electronics
- ✓ Sensors
- ✓ Field Effective Transistors
- ✓ Filtration Membranes

## INVENTORS

Dr. Noushin Nasiri

## INTELLECTUAL PROPERTY POSITION

**Micro-nano Clustered Films**

AU Prov 2022900599

## PARTNERING OPPORTUNITY

We are seeking an industry partner for further development and commercialisation of this technology through a research collaboration or technology licence.

## WOULD YOU LIKE TO KNOW MORE?

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