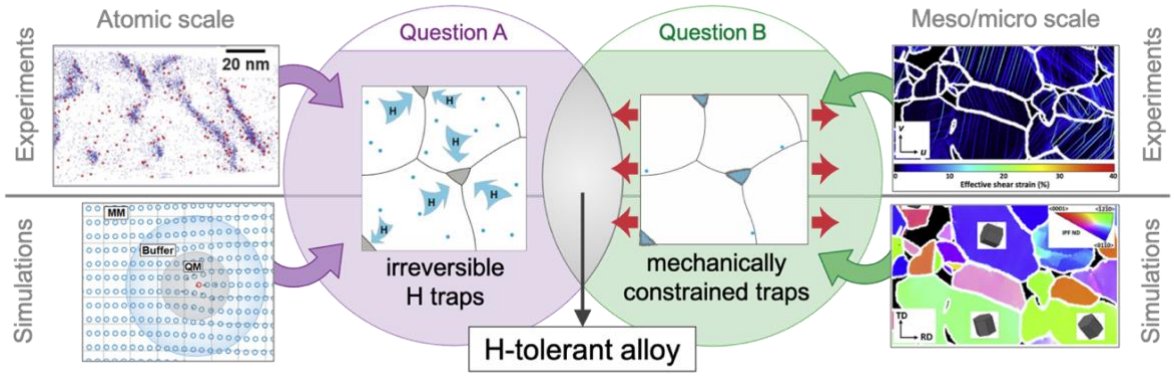
# Rethinking alloys for a hydrogen economy

PhD position at UNSW, in collaboration with Monash, USyd, and ANSTO.

Many countries world-wide have recognised that hydrogen will play an important role in deep decarbonisation of society[1]. Australia has set ambitious national goals aimed at reducing the carbon footprint of the nation while entering an export market worth over $150 billion[2,3]. However, a major roadblock to the transition to hydrogen fuels is the development of H-resistant metal alloys.

Hydrogen embrittlement (HE) is a severe materials degradation process that can cause catastrophic failure of engineering components. Even now, without an established hydrogen economy, HE accounts for a significant portion of corrosion failures, which are estimated to cost globally $3 trillion AUD a year[4]. HE is also preventing the wide-spread use of ultra-high-strength alloys for lightweight constructions, which could reduce the carbon footprint of the automotive sector by an additional 18% by 2050 (on top of electrification)[5]. HE will become even more prominent with increasing adoption of hydrogen fuels.

This project aims to develop a new strategy to mitigate hydrogen embrittlement of metal alloys by creating a sacrificial phase within the alloy that irreversibly traps hydrogen and that is microstructurally engineered not to affect the overall mechanical properties of the alloy. To tackle this ambitious goal, we have set up a collaboration between four leading research groups: Dr Patrick Burr at University of New South Wales, Prof Julie Cairney at The University of Sydney, Prof Michael Preuss at Monash University and A/Prof Ondrej Muránsky at The Australian Nuclear Science and Technology Organisation.




We are seeking two PhD candidates to work collaboratively across the institutions. One candidate will focus on experimental techniques, using world-leading capabilities in cryo atom probe tomography and in-situ mechanical testing, while the other candidate will focus on state-of-the-art modelling method from the atomic scale to the micro scale. The students will receive a full PhD scholarship with stipend and up to $10,000/year top-up. We value diversity and encourage applications from all backgrounds to apply. A background in materials science, materials engineering or physics is welcome.

To apply, email your CV and transcript of most recent or current degree to p.burr@unsw.edu.au.


1 *Global Trends and Outlook for Hydrogen* International Energy Agency Hydrogen Technology Collaboration Program (2017)
2 *Technology investment roadmap discussion paper*, Australian Dept. Industry, Science, Energy and Resources (May 2020)
3 *Australia's National Hydrogen Strategy*, Australian Dept. of Industry, Science, Energy and Resources (2019)
4 FG Hays, *Now is the Time*, World Corrosion Organisation (2012)
5 E Windisch, V Benezech, G Chen & J. Kauppila, *Lightening Up: How Less Heavy Vehicles Can Help Cut CO2 Emissions.* OECD (2017).