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# 'One layer at a time': Unlocking Novel Materials and Structures for Neutron Radiation Environments through Additive Manufacturing

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The fact that neutrons can penetrate deeply makes them an excellent tool for probing the inner structures of materials, however this property also means that effective management of neutron radiation is a central challenge in nuclear engineering, neutron beam science and in the electronics industry. Neutrons also form a significant proportion of space radiation, and therefore novel, lightweight materials and structures for space radiation shielding are at the forefront of Australian and international space science development.
Additive Manufacturing provides opportunities for creating novel structures with often complex geometries
– and in materials not otherwise possible with traditional manufacturing techniques.
We have brought together a team through the ANSTO-UOW Seed Funding Scheme to focus on the question: "Can the structures and materials made possible by additive manufacturing enable novel solutions for neutron radiation environments?"
Our work to date has focused on three main themes:
**THEME 1** – Polymers for neutron shielding and collimation: particularly focusing on boron nitride/polymer composites and the possibilities these composites, coupled with 3D printing techniques, can open for neutron shielding and collimation applications – both terrestrial- and space-based;
**THEME 2** – Low-hydrogen polymers for neutron sample environments: focusing on 3D-printable polymers for additive manufacturing low-background components for neutron sample environments;
**THEME 3** – Metals and alloys for neutron sample environments: investigating additive manufacturing of metals
– particularly aluminium – and alloys for neutron environment components.
This presentation discusses the opportunities and some of the promising approaches for neutron environment additive manufacturing and novel composite materials – with specific examples and initial results from this collaborative endeavour.

*Figure 1 - Neutron transmission reduction from different thickness/BN % configurations of boron nitride/polyurethane composite ples - taken at ANSTO using the Taipan instrument (left); and titanium 3D printed 'sample t) showing the
capabilities of metal additive manufacturing for producing neutron environment components.*

## Speakers Gender

Male

## Level of Expertise

Expert

## Do you wish to take part in the poster slam

No

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