

Bioinspired Multifunctional Ceramics

For: PhD Students; 12 months

Program supported: [Advanced Manufacturing](#)

Academic Collaborator	NRC Principal Investigator	Associated NRC Research Centre
McGill University	Hamidreza Yazdani Sarvestani (Researchgate)	Aerospace Research Centre

Project Description:

Ceramics are highly coveted in mechanical, biomedical, and electronic applications owing to their excellent thermo-mechanical properties. However, they generally suffer from brittleness. Several strategies, employed to overcome the inherent brittleness of ceramics, fail to significantly improve their impact resistance and toughness and restricted to laboratory scale manufacturing. Nature's inspiring motifs and unique design concepts can open new avenues to solve ceramics' brittleness.

In this project, we will develop ceramic systems with bio-inspired architectures with an enhanced toughness. The advanced ceramics will be manufactured by using additive/subtractive manufacturing technologies. The student will work within a group of students and researchers on design, manufacturing, testing and analyzing data. The student will be trained how to manufacture the ceramics and how to perform different thermo-mechanical tests. Both the developed additive and subtractive manufacturing technologies through this project advanced knowledge from breakthroughs leading to a better, safer, more prosperous future for Canada and could open a new niche for ceramic composites within the advanced manufacturing ecosystem in Canada and NRC.

The multifunctional architected ceramics could be applied to aerospace, energy and defense sectors for applications such as personnel protective equipment with multi-hit capability, thermal protection systems and propulsion components. For example, gas turbines have an essential role in the global energy markets and any improvement in their efficiency has a significant environmental and economic impact. NRC Aerospace has been a long standing partner with aerospace engine manufacturers (e.g., GE and Pratt & Whitney).

Student Profile:

The student should have the following skills/background:

- Ability to work in a team
- Fundamental of solid Mechanics
- Fundamental of Materials Engineering
- Basic knowledge of CAD software
- Basic knowledge of a finite element software