

The NRC will take part in the [RAPID and TCT conference](#), from May 2-4 in Chicago

Experts from the National Research Council of Canada's (NRC) will be taking part in the [RAPID and TCT conference](#), North America's largest additive manufacturing event. This industry-leading event will take place from May 2 to 4, 2023 in Chicago. [Register now online](#) for the chance to chat with us about the latest in 3D printing.

This event welcomes over 10,000 additive manufacturing professionals from around the world to discuss the latest trends in 3D printing technologies and leading-edge manufacturing research.

Don't miss out on learning about the latest in 3D printing and the NRC's unique expertise in additive manufacturing, including digital simulation, machine learning and artificial intelligence to solve critical industry challenges.

The team of NRC experts will be presenting 3 projects conducted under the [METALTec Industrial R&D group](#) at the event. Thank you to all METALTec members and partners for their contribution to these projects and to the Natural Sciences and Engineering Research Council of Canada (NSERC) and the Centre québécois de recherche et de développement de l'aluminium (CQRDA) for their financial support.

Project 1

Conference title: On the use of LPBF 300 Grade maraging steel (Fe-18%Ni) for aluminum alloy die casting

Speakers: Ehab Samuel (National Research Council of Canada), Mihaela Vlasea (University of Waterloo)

Challenge: Additive manufacturing of die casting tooling made of maraging steel has already been implemented as a solution for very demanding application cases, when heat management is critical. However, there are still risks of premature failure for these inserts and the root cause for these is unclear. Could that be related to material, process, design or a combination of all elements?

Objective of the project: This project aims at clarifying the impact of the different factors on the expected lifetime of components made of maraging steels by laser powder bed fusion in order to provide the toolmaking industry with guidelines to manufacture high performance, durable, die casting inserts.

Partners: University of Waterloo, METALTec members

Duration: 2 years (2020-2022)

Key results: A key outcome of this project is that the legacy heat treatment protocol for maraging steels that has been developed on wrought maraging is not tailored to this material processed by laser powder bed fusion. This difference can lead to a major improvement of the performance of the very same material and highlight the importance of reconsidering the full manufacturing process when going the additive path.

Project 2

Conference title: Automated Extraction of Quantitative Microstructural Data for AI-Driven Process Optimization

Speakers: Siyu Tu (National Research Council of Canada), Phuong Vo (National Research Council of Canada)

Challenge: Machine Learning comes with the promise of accelerated development time, greater agility and higher performance, but at the cost of large data volumes. Gathering all these data in a time- and cost-effective way can be very challenging, especially for SMEs.

Objective of the project: This part of a larger project had for objective to develop an AI (artificial intelligence) framework capable of automatically extracting quantitative data from microscopic images in order to predict performance and quality of the tested material, and applying it to metal additive manufacturing.

Partners: METALTec members, CQRDA (funding)

Duration: 2 years (2020-2022)

Key results: Using cold spray additive manufacturing (CSAM) of aluminum alloys as a case study for this development, the team has been able to develop routines to automatically extract complex microstructural data, using deep learning algorithm, and then use predictive models to guide and accelerate CSAM process optimization, with a data volume compatible with SMEs reality.

Project 3

Conference title: Heat management through topology optimization and lattice structures

Speakers: Marjan Molavi Zarandi (National Research Council of Canada), Prof. Mathieu Brochu (McGill University)

Challenge: Die casting industries in aluminum face a number of challenges. As casted parts become increasingly complex, there is a growing need to improve productivity (reduce cycle time), effectiveness (reduce scrap rates) and agility (minimize development time). Tooling heat management is paramount to increasing productivity and quality, nevertheless this can become a challenge when dealing with complex geometries. Can additive manufacturing be part of the solution?

Objective of the project: The project aims at tackling the heat management optimization challenge through two complementary avenues, which are both related to additive manufacturing: 1) Develop a digital platform capable of optimizing cooling channel design to improve heat management considering the manufacturing process constraints; 2) Develop a tool steel-based, high thermal conductivity composite structure through the use of laser powder bed fusion which can significantly enhance the heat management performance of tooling.

Partners: McGill University, METALTec members, NSERC (funding), CQRDA (funding)

Duration: 3 years (2020-2023)

Key results: The team has been able to develop a first-of-its-kind digital platform that predicts the position and size of conformal cooling channels by using multi-physics topology optimization, resulting in maximizing die casting cavity temperature uniformity, a key factor in ensuring part quality and reducing scrap rates. Moreover, a composite H13 tool steel/copper lattice structure was manufactured through laser powder bed fusion, with improved thermal conductivity compared to a pure H13 die casting tool and good expected mechanical properties. Both solutions could be used separately or as a combination in the future to allow the die casting industry to tackle more and more complex applications.

Contact us

The METALTec industrial R&D Group is currently open for new members. For more information on how to become a member, please contact:

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What is METALTec?

METALTec is an industrial research and development (R&D) group led by the National Research Council of Canada (NRC). It offers its member companies the latest developments in the manufacture of metal products for the transport sector. METALTec catalyzes innovation by creating a research community with participants from across the value chain, from raw material suppliers to major vehicle manufacturers.

Its objective: to bring solutions to common industry problems through pre-competitive research projects. The results of these projects will enhance the capabilities of partner companies in the manufacturing, assembly and durability assessment of advanced components and several materials with specially adapted properties.

METALTec now has 31 active industrial members, 10 partners and 8 academic collaborators who share the cost, risks and benefits of pre-competitive research projects estimated at \$4M per year.