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National Graduate Innovation Forum

Industry Partner Challenges

BlueScope Steel – Project Summary

Compatibility of coil coated steel building products with traditionally incompatible building materials

BlueScope

BlueScope is a provider of innovative steel materials, products, systems and technologies and are one of the world's leading manufacturers of painted and coated steel products. With strong expertise in steel BlueScope provide vital components for houses, buildings, engineered structures, infrastructure and more. BlueScope's most recognised product brands include COLORBOND® steel, TRUECORE® steel and ZINCALUME® steel, and also the LYSAGHT® brand of quality steel building products.

Coil coated steel products are widely used in building applications, particularly in roofing, cladding and rainwater management applications, due to their inherent features of high strength, light weight and long service life. Coil coated steel products typically feature a metallic coated steel substrate and may also have additional organic coatings. Corrosion resistance is imparted to the steel substrate by galvanic corrosion protection of the sacrificial metallic coating.

Some common building materials are not generally recommended for use with coil coated steel products, e.g. lead flashing, copper gutters and downpipes and stainless-steel fasteners and fixing screws. Contact between these dissimilar metals and coil coated steel products in the presence of moisture can result in accelerated corrosion due to the formation of a localised galvanic cell, compromising aesthetics and reducing service life. Whilst moisture is essential, the presence of corrosive contaminants like marine salts and other pollutants can exacerbate this effect.

Contact between coil coated steel products and other building materials can be indirect or direct. Indirect contact refers to the formation of so-called "inert catchments", where water that contacts the more cathodic (inert) material flows onto the more anodic (active) material. More commonly observed however is direct contact, where the more cathodic (inert) material is both physically and electrically connected to the more anodic (active) material, creating a localised galvanic cell.

Practical solutions to reduce or eliminate galvanic corrosion arising from the use of dissimilar metals are sought. For this project, solutions that enable the use of stainless-steel fasteners in marine environments are sought. Solutions may either be a means of greatly reducing the magnitude of the potential difference of the galvanic couple when it forms, or a simple means of electrical isolation that prevents the formation of a galvanic couple altogether.

Airbus – Project Summary

Airbus Australia Pacific has more than 1500 employees across 20 sites in Australia and New Zealand, are part of the largest aircraft manufacturing company in the world and global leader in aerospace and related services. In the space sector Airbus is focused on making space a universe of possibilities for everyone, developing innovation and maximising Australian expertise and capabilities to support the future Australian space industry.

Electronic components and systems on space missions are subject to space radiation fields from solar activity and cosmic rays, which can cause serious system faults that can potentially lead to mission failure. Single event upsets (SEUs) from cosmic rays and Total Ionizing Dose (TID) need to be anticipated and steps taken to harden electronic packages against their effect, mitigate the effects with software or at least gauge their likelihood prior to the mission.

Low Earth Orbit (LEO) missions are a current short-term focus for the Australian Space sector and while these involve lower levels of space-based radiation than other missions such as Geo-synchronous Earth orbit (GEO), radiation-induced electronic failures are still a risk.

Airbus must include considerations of these effects in their satellite systems and radiation hardness with radiation modelling testing forming a part of their accreditation process.

AIRBUS

This is an opportunity for physics and electronic engineering students to participate in a project built around risk models for LEO and GEO missions utilising open-access software and information resources such as SPENVIS and GEANT4 to calculate likely radiation doses and event probabilities for different types of components. The other aspect of this project would be in the development of suitable apparatus whereby common electronic components (such as microprocessors or FPGAs) could be continuously monitored for faults whilst subjected to known amounts of radiation.

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Romar Engineering – Project Summary

Romar Engineering started as a mom & pop shop in 1968 making plastic tooling for Australia's automotive sector, and today is Australia's largest silicone consumables producer for the IVF industry. Romar fields a deep engineering team with production facilities for metal additive manufacturing (L-DED and L-PBF), plastics injection moulding, elastomers compression/transfer/overmoulding, and 3- and 5-axis CNC milling. Romar has been the nucleation site for many large companies throughout the years, taking early-stage research through the TRL scale to commercialisation (and TGA manufacturing approval if necessary). ISO 9001 and 13485 quality accreditations coupled with a state-of-the-art biomedical cleanroom and a committed production staff ensure a scalable manufacturing solution for our customers products and devices. Romar is currently endeavouring to become Australia's first domestically-owned, vertically integrated fluid and motion controls supplier for the local space industry.

Hybrid manufacturing at Romar couples Laser-Directed Energy Deposition (L-DED) with simultaneous 5-axis CNC milling and on machine verification to produce large components up to ⌀600mm x 400mm tall through both additive and subtractive means. Large impellers, turbine housings, heavy wall ducting, and wear-resistant components for the energy, space, defence, and industrial sectors are examples of parts manufactured on this platform. The technology is proving ideal for die casting mould repair, offering a more economical, expedient, and sustainable option to traditional methods of repair.

The stochastic nature of the L-DED process all but guarantees the need for non-destructive evaluation (NDE) to verify metallurgical integrity of each manufactured part. Romar's platform has onboard image capture hardware and software to monitor the temporal evolution of the meltpool, with data stored in both large data arrays and 2D time-based data. Using these, and additional, sensors we would like to evaluate the build process posthumously and perform statistical analysis on key meltpool and part parameters.

ROMAR
Scalable Manufacturing Solutions

The project goal is not to sidestep NDE, but approach volumetric inspection more intelligently. This topic is ideal for inquisitive students in science and engineering to take real-world data and build a software post processor for visualisation of a medium-speed additive manufacturing process, with immediate and direct benefits to both industry and academia. Initial work will enable rapid fault detection and suggest areas of scrutiny for NDE. Long term there will be established heuristics and a path to qualify manufactured part integrity, avoiding costly volumetric inspection.

Thales Group – Project Summary*

The Thales Group with 80,000 employees world-wide and operating in 68 countries is one of the largest players in the defence sector and a key supplier to Australian Defence. It has a significant manufacturing presence in Australia (more than 3000 employees) which includes a highly specialized site in NSW manufacturing piezo-ceramics for naval sonar arrays and systems. This operation is unique in Thales and has very few competitors from other companies overseas.

The process of manufacturing the piezo-material Lead Zirconate Titanate (PZT) is complex and Thales Australia is looking to improve the characterization of two aspects of its ceramic processing: raw ingredient milling and product sintering.

The milling project goal is a clear understanding of the importance of different milling parameters to feed homogeneity and quality of the final product. The sintering project will investigate the effects of different sintering temperature profiles on grain development, lead loss and ultimately final product performance.

This is an opportunity for chemical and materials engineers or scientists with an interest in smart materials and access to ceramics preparation/sintering facilities to work with a world-leading manufacturing operation.

As this project involves an association with classified technology, there is a requirement that all members of the prospective project team be Australian Citizens with certain restrictions on dual citizenship.

THALES

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