

# AEROSPACE MANUFACTURING TECHNOLOGY

## ***Resistance Welding of Thermoplastic Composites***

The NRC Institute for Aerospace Research (NRC Aerospace) has expertise and facilities to investigate technologies for joining thermoplastic composites.

Thermoplastic composites, which can be used for both primary and secondary aerospace structures, offer many advantages. They have high damage tolerance, excellent corrosion and solvent resistance, high fracture toughness and impact resistance, good fatigue resistance, low storage cost, and infinite shelf life. Their strength- and stiffness-to-weight ratios are superior, and they can be reprocessed, repaired, recycled, and welded. Their main disadvantage is that they require high processing temperatures and pressures. Material costs are also high.

NRC Aerospace is therefore developing new, rapid, reliable, and cost-effective thermoplastic composite joining and assembly techniques that can reduce overall manufacturing costs. Such techniques are expected to replace traditional joining and assembly methods, including adhesive bonding, mechanical fastening, and co-consolidation bonding.

The focus of current research is on developing resistance welding, a new technology for joining large parts in a continuous/progressive manner. The process involves placing a layer of conductive material, such as a metal mesh or a carbon strip, between two surfaces, then applying an electrical current to heat the element and melt the thermoplastic polymer at the weld interface. At the same time, pressure is applied to consolidate the polymer chains across the interface.



*Resistance welding*

The materials being used for this research include:

- Unidirectional APC-2/AS4 laminates
- Glass/PP plates
- Stainless steel heating elements
- APC-2/AS4 heating elements.

The technique is suitable for automation. Power requirement is low, and temperature distribution is well controlled at the interface, with minimal heating effect at the weld edges. Weld strengths of up to 60% of the base material have been achieved.

A patent application has been filed for the continuous resistance welding technology for thermoplastic composite joining and licensees are actively being sought.

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