

CASE STUDY

Rotite Technologies Ltd

Rotite Technologies and DRAMA collaborate to develop a metallic AM Rotite® advanced fastening system.

THE CHALLENGE

Rotite Technologies Ltd is an industrial technology business with a unique and globally patented technology. They are focused on developing advanced fasteners and connectors for customers in the aerospace, automotive, marine, manufacturing, consumer goods and construction industries.

A key to Rotite Technologies expertise is in the delivery of new prototype products incorporating Rotite® technology for customers, proof-of-concept and pre-production projects. They also have a deep and broad knowledge of advanced manufacturing technologies, enabling them to undertake collaborative technical development programmes.

Rotite Technologies provides proof-of-concept packages for customers with the aim of licensing its proprietary fastening, joining technology - also called Rotite®. This unique fastening, joining and coupling technology is simple and adaptable, whilst offering a low profile, high speed and high strength solution.

Many configurations are available including mating and genderless parts. It creates an exceptionally stable joint capable of rapidly applying high preloads. It has high tensile and very high shear resistance. It is programmable and has highly predictable failure modes.

Rotite Technologies have previously made Rotite® configurations using injection moulding, EDM, five axis machining and polymer Additive Manufacturing (AM) - however they had a desire to understand if and how they could use metallic AM methodologies in order to appeal to wider markets. In this DRAMA project, Rotite Technologies sought to understand the opportunities and challenges presented by metallic AM. A two stage approach was agreed between the NCAM and Rotite - in stage 1 of the project the feasibility of using Metal AM for identified Rotite® components would be assessed, whilst in stage 2 an AM method of manufacture would be designed and demonstrated to validate AM as a potential alternative process for the production of the Rotite fasteners.



Evolution of Rotite® components (left-to-right): Injection Moulded; Machined; Polymer AM

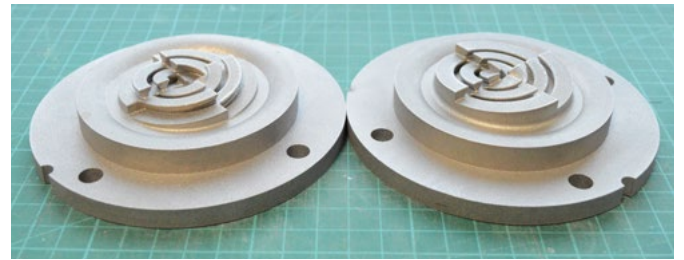
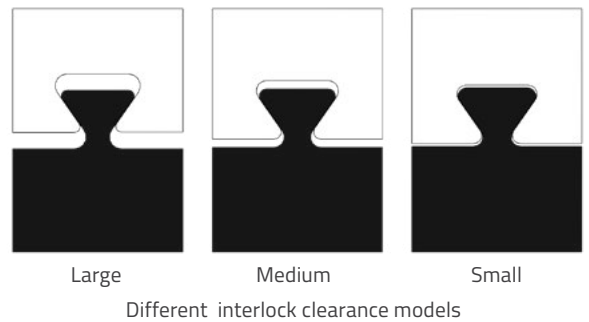
THE OUTCOME

Working closely together, NCAM and Rotite Technologies set out to assess and prepare the identified Rotite® CAD geometries for AM. Following an AM material and process selection exercise, Aluminium AlSi10Mg (as it is well characterised and practical for destructive testing) and the Laser Powder Bed Fusion (L-PBF) process (based upon the selected material criteria, requisite density and DfM report) were chosen for this project. The builds would take place at Renishaw's headquarters in New Mills, Gloucestershire, on the RenAM 500Q platform. The aim with these parts was to achieve a secure interlock with minimal post-processing (i.e. powder removal and bead blasting), then conduct destructive testing to understand joint performance.

Post-build, it became apparent that the first batch of parts failed to interlock due to insufficient clearances. The decision was then made to carry out two further builds containing a number of parts with a range of different clearances. Following stress relief heat treatment and wire-EDM for part removal, the new parts interlocked successfully. Once the NCAM team had conducted their GOM Scans for geometry analysis, the Rotite team carried out Clearance Model tests using Simulation Tool Modelling. The results were conclusive and Rotite Technologies are keen to continue their work with the NCAM team as well as others, to further their journey in Additive Manufacturing.

Rotite Technologies have gained invaluable knowledge into metal AM and plan to pursue parallel AM projects to further their developments. The next steps are to carry out the planned destructive testing programme using the DRAMA-built AlSi10Mg components. They also wish to secure development partners in AM to carry out further light-weighting activities and undertake physical testing in other well-characterised materials including Inconel 718.

In addition to the work on Metal AM Rotite Technologies have invested in polymer AM machines and finishing equipment, to develop a range of Nylon SLS products incorporating the Rotite® technology.



AlSi10Mg Rotite® components

Working on the DRAMA programme with the NCAM team has allowed us to undertake key research in the validation of our Patented fastening technology Rotite®. There are many synergies between AM production techniques and the generation of Rotite® integral fastening features. The specialist knowledge that the team at the NCAM provided us, has been invaluable and will inevitably further our engagement with our partners as they move towards AM component production with embedded Rotite® Technology.

Stuart Burns, Founder & Innovation Director, Rotite Technologies Ltd

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DRAMA - a collaboration of eight partners
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