



BEAMIT Group has developed AM process for highest performing Aluminium alloy: Al2024 RAM2C

The ultralight Aluminium alloy 3D printed by BEAMIT also performs well at high temperatures: perfect for applications in the Motorsport, Automotive and Aeronautical sectors.

Fornovo di Taro (Parma, Italia) 28 June 2021 - Every day more industries turn to Additive Manufacturing and invest in a constantly evolving technology to produce components that outperform those made with conventional processes. Recently there has been an increased demand particularly in the Motorsport sector for Aluminium alloys that combine the ability to maintain high-performance levels irrespective of the temperature with extreme light weight. BEAMIT Group was quick to respond and BEAMIT Group President Mauro Antolotti said, "Our priority is to offer customers advanced materials and processes so they can transfer these innovations directly and effortlessly to their products. This continually evolving advancement is an integral part of our Group's long-term strategies and supported by a strong, well-organised team focused on achieving even more competitive results."

Produced via Additive Manufacturing with a process parameterised in BEAMIT, the 2024 RAM2C Aluminium alloy performs better at both room temperature and high temperatures than other alloys currently in use, plus it is exceedingly tough as well as extremely lightweight. These characteristics make it perfect for applications in the Motorsport and Automotive sectors for components like the suspension, parts of the chassis and structural parts of the powertrain – so basically any part near the engine.

The alloy processed with conventional technologies is commonly used for the structural parts of aircraft, but Additive Manufacturing opens up new horizons for the future of Aerospace design, enabling the production of much lighter and higher performing structural parts which would bring down energy consumption and costs.

Until now, 2000 series Aluminium alloys, including 2024, were known in the AM world for their inability to be processed via Additive Manufacturing due to their composition. The elements in alloys (such as Copper, Zinc and Magnesium) solidify at completely different temperatures and it becomes very difficult to melt them with a laser to create solid elements. The first step of the project was in collaboration with Elementum 3D: choosing to print with Elementum 3D's Al2024-RAM2C material, a 2000 series Aluminium alloy composition modified with their patented RAM additions. The toughest challenge was discovering the ideal process window for the alloy. BEAMIT Group's R&D team benefits immensely from the integrated processes offered by a fully integrated value chain and took a multidisciplinary approach that resolved the problem. "The 2024 alloy perfectly embodies what we mean when we talk about the integrated development of the additive process. It has been made possible by a multidisciplinary research group and access to unique machinery to study and apply top-level precision processes to achieve a result like we did in this case, which we can safely say is decidedly extraordinary," said BEAMIT Group General Manager Andrea Scanavini.

Aluminium alloys necessarily need to be subjected to heat treatments to achieve maximum levels of mechanical performance, so a specific cycle was custom built for the 2024 RAM2C alloy. Varying the heat treatment can actually vary how the material performs. In addition to finding the ideal solution for the alloy's heat cycle, BEAMIT Group's R&D team developed different post-printing processes enabling customers to have modular solutions with customised properties. BEAMIT Group Material and Special Processes Manager Alessandro Rizzi explains, "It is very difficult to process 2000 series Aluminium alloys via L-PBF so developing this material really motivated us. Furthermore, the role of heat treatments became fundamentally important for Al2024 RAM2C and enabled us to experiment different ones to find repeatable stable processes and guarantee maximum performance, including in-air and HIP-Q treatments." In fact BEAMIT Group is currently working on parameterising the high-pressure heat



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treatment process in collaboration with the subsidiary PRES-X, the innovative start-up that uses cutting-edge technologies for special post-production processes within BEAMIT Group.

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About BEAMIT Group

BEAMIT Group is one of the most advanced additive manufacturing service providers in the world and serves the most demanding industries through its strategic positioning as a one-stop shop: the first company to become a truly global additive manufacturing (AM) hub offering a fully integrated value chain. Based in Fornovo di Taro (Parma, Italy), BEAMIT has been operating in the field of AM with metal powders for 24 years. With close to 60 dedicated AM systems distributed across 7 facilities in Italy and the UK, the Group now counts over 140 employees.

BEAMIT Group specialises in high-end metal AM components for demanding industries like aerospace, automotive, energy, racing and industrial engineering, and holds many relevant quality certifications, including AS/EN 9100:2018 for aerospace, IATF Automotive, NADCAP accreditation for heat treatment processes and laboratories, and NADCAP accreditation for welding – additive manufacturing commodity.

In 2019, **Sandvik Group**, global leader in hi-tech engineering and metal powder with the widest range of alloys for additive manufacturing as well as remarkable expertise in AM printing technologies for advanced metal components, acquired a significant stake in BEAMIT.

In 2020, BEAMIT acquired a significant stake in PRES-X, an innovative start-up in the field of special post-production processes for 3D printing. BEAMIT then acquired 100% of Italian AM service bureau ZARE.

In 2021, BEAMIT Group acquired 3T Additive Manufacturing (Newbury, UK). 3T Additive Manufacturing holds some of the highest quality certifications for deliveries to aerospace and medical and is an approved supplier for serial production by many leading OEMs across the UK, Europe, US and Japan.

BEAMIT Group has a turnover of €22 Mio.

For further information: <https://www.beam-it.eu/ENG/index.php> - <https://www.pres-x.com/> - <https://www.zare.it/> - <https://www.3t-am.com/>

Photos: https://drive.google.com/drive/folders/19-jgNcgL-VJRSaILlzuHTemul_0pSPTm?usp=sharing

- 1) Al 2024 RAM2C (NHT_1_12.5X)
- 2) Al 2024 RAM2C T6 (T6_ETCH_1_100X)
- 3) Al 2024 RAM2C T6 + Hipping (HIP+T6_ETCH_1_50X_bis)
- 4) Heat-treated Al2024 RAM2C metallographic specimens
- 5) 3D-printer used in the production of Al 2024 RAM2C components at the Fornovo di Taro headquarters
- 6) Mauro Antolotti - BEAMIT Group President – Laboratory
- 7) Alessandro Rizzi, Material and Special Processes Manager BEAMIT Group
- 8) Metal powder - Aluminium

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Additional information

The alloy

Al2024 RAM2C is a 2000 series Aluminium alloy whose composition was modified by Elementum 3D by adding 2% of a Ceramic phase. It guarantees excellent mechanical properties at both room temperature and high temperature combined with high corrosion resistance.

The chemical composition of 2000 series alloys primarily consists of Aluminium, Copper and Magnesium (with the latter as a minor alloying element), which are essential elements for mechanical strength. These elements form intermetallic phases (such as Al_2Cu and Al_2CuMg) evenly distributed throughout the structure of the material.

Heat treatments produce the precipitation of secondary phases and increased mechanical properties.

This alloy is of interest to the Aerospace and Motorsport sectors as they require fatigue resistance and fracture toughness.

Post-production processes at PRES-X

Various heat treatments were experimented to achieve the maximum performance capabilities of 2024 RAM2C Aluminium alloy. More specifically, the innovative start-up PRES-X, a BEAMIT Group subsidiary specialising in post-production processes for 3D printing, developed the HIP-Quench treatment. This is a heat cycle in which HIPping, a high-temperature high-pressure treatment used to eliminate any flaws caused by the moulding process (100% of a material's theoretical density can be achieved) while maintaining a product's geometric and dimensional properties, is combined with quenching, which is only done in Italy by PRES-X using the QIH 60 M URC press that achieves cooling rates of over 3,000°C/min.