BEAMIT develops additive manufacturing process for Titanium Ti6242: a breakthrough for sustainable industrial production.

BEAMIT analysis shows that the Ti6242 Titanium alloy printed with additive technologies for motorsport and aeronautical applications performs better than alloys processed with conventional technologies.

Fornovo di Taro (Parma, Italy) 06 April 2021

The BEAMIT Group has always been at the forefront of providing the market with advanced innovative solutions in the shortest time possible: and it has succeeded again by developing an additive manufacturing process for the Ti6242 Titanium alloy. “Our hard work is essentially geared towards positioning ourselves on a level where we can produce innovation and change the rules of the game technologically and for 3D-printing applications. We are extremely focused on our clients’ needs and productivity and use our Material and Process Engineering division to respond with turnkey solutions for the next generation of production processes” says Andrea Scanavini, BEAMIT Group General Manager.

The motorsport sector has been looking at 3D-printed Titanium alloys for high-temperature applications since 2019. Before then they were almost solely available produced with conventional technologies, such as forging.

What makes Ti6242 such a highly innovative and unprecedented material is its specific resistance to high temperatures: the alloy produced by additive manufacturing has a tensile strength of up to 1000 MPa and a density of 4.5 g/cm^3.

Although some materials used to produce motorsport and automotive components achieve similar levels of tensile strength as Ti6242, they are significantly heavier. Using the Titanium alloy considerably reduces the weight without losing any of the strength. So many components made for motorsport applications can benefit from this material, like exhausts which were made with nickel superalloys until now.

The composition of Ti6242 produced by additive manufacturing is also ideal for components made for the aeronautical sector where its use is gradually becoming more widespread. The first titanium alloys were developed at the end of the World War II for use at high temperatures and to completely replace nickel superalloys in supersonic aircraft engines.

Giuseppe Pisciuneri, BEAMIT’s Chief Commercial Officer, says, “Researching and developing new materials has always been fundamentally important in the BEAMIT Group and we are very proud to currently be the only company capable of offering the market top-flight technological solutions, especially in sectors like motorsport, automotive and aerospace. Being pioneers of this innovation and using our materials in our clients’ new projects motivates us to keep growing and spurs us on to bigger and better things.”

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The first step for BEAMIT was an in-depth study to see which of these alloys could be processed by additive manufacturing with laser powder bed fusion, and Ti6242 produced the outright best performance.

The aim was to optimise the material's mechanical properties at temperature. "Development of the Ti6242 process began in 2019 as part of a thesis project in collaboration with Politecnico di Milano university" says Alessandro Rizzi, BEAMIT Group Materials and Special Process Manager. "The material adapted perfectly to laser powder bed fusion (LPBF), but our real focus was on the heat treatments. We devised different vacuum cycles to optimise its mechanical properties at room temperature and at high temperatures and also developed the integrated high-pressure heat treatment process."

The result was a 3D-printed component that performed even better than components forged with conventional technologies. This proves that successfully processing even more materials with additive manufacturing means being at the forefront of the technical field and represents a revolution particularly in the field of sustainability, as we can save material by using only what is strictly necessary and recycle remaining powders for the next project.

HIGHLIGHTS

- Specific resistance: high tensile strength combined with extreme lightness
- Withstands temperatures as high as 550°C
- Complex shapes can be printed

Additional information: Attachment 1, graphs comparing 3D-printed and forged Ti6242

For further information, please visit www.beam-it.eu - www.zare.it/en - www.pres-x.com

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Photos

1. Andrea Scanavini, BEAMIT Group General Manager
2. Ti6242 microstructures
3. Component in the ZARE quality control department
4. Isabella Franchi, BEAMIT Group Lab Technician
5. BEAMIT machinery - Rubbiano (PR)

BEAMIT Group

Based in Fornovo di Taro (Parma), **BEAMIT Group** has been operating in the field of additive manufacturing (AM) with metal powders for 24 years. With 48 AM dedicated additive manufacturing systems distributed in over 5 facilities in the area of Parma and Reggio Emilia and over 100 employees, it is the largest 3D-printing hub in Europe and has proved to be one of the world's most important companies in the global AM sector. BREAMIT Group specializes 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, NADCAP approval (National Aerospace and Defence Contractors Accreditation Program), and IATF Automotive.
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. It then acquired 100% of AM service bureau ZARE, enabling Europe's two leading companies to join forces and create the largest global additive manufacturing group to serve the most demanding industries.

Attachment 1

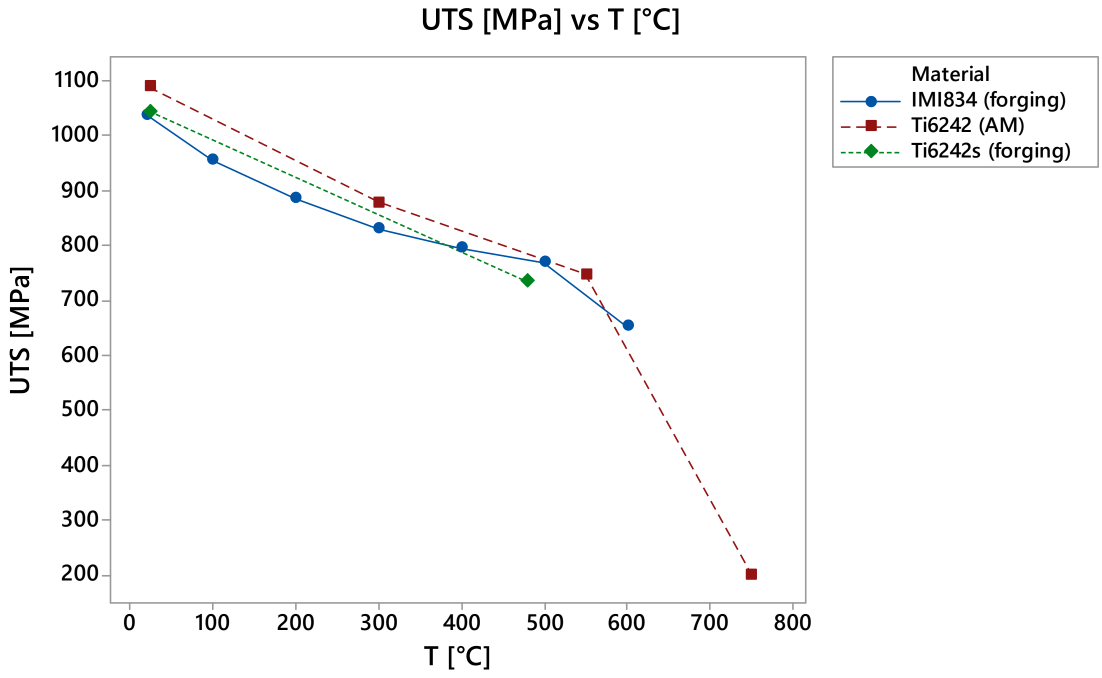
ADDITIONAL INFORMATION

The potential of Ti6242

Ti6242 produced via LPBF has a yield strength of around 1000 MPa at room temperature, which remains over 600 MPa up to 550°C, and a density of 4.5 g/cm^3. Combined these two properties produce a high specific resistance (strength-to-weight ratio) which makes Ti6242 an attractive solution for all applications requiring good mechanical strength plus light weight. Ti6242 is therefore a valid, “lighter” alternative to steel and nickel superalloys.

Characteristics

Ti6242 produced via LPBF and then subjected to solution heat treatment (above the beta-transus temperature) and ageing was characterised by tensile tests at room temperature and also at 300°C, 550°C and 750°C. (NB: these alloys are usually used for applications up to 550°C; the 750°C test was conducted to explore how it behaved at above normal working temperatures). From these graphs, we can see that the mechanical strength in terms of ultimate tensile strength (UTS) and yield strength (YS) of AM-produced Ti6242 (in red) is comparable if not even better than the properties (available in the literature) achieved by Ti6242 and by IMI834 (one of the highest-performing Titanium alloys at high temperatures) produced with conventional technologies (forging). The ductility of Ti6242 (AM) is confirmed by the elongation at break (ε) values.



Worksheet: Comparison between AM and forging

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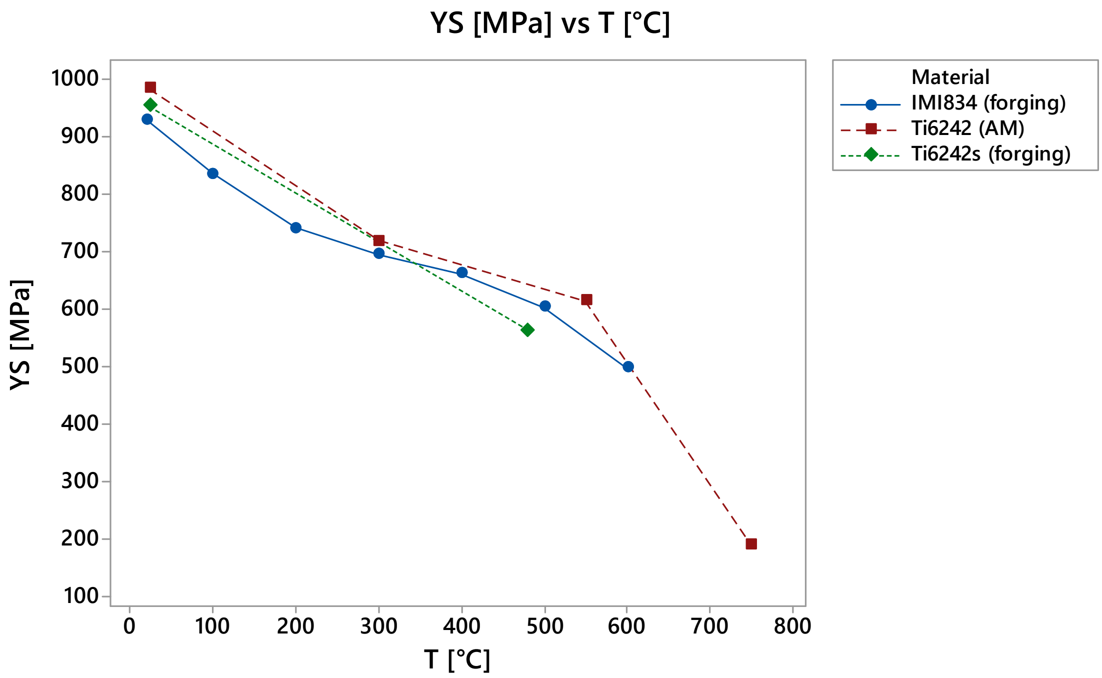

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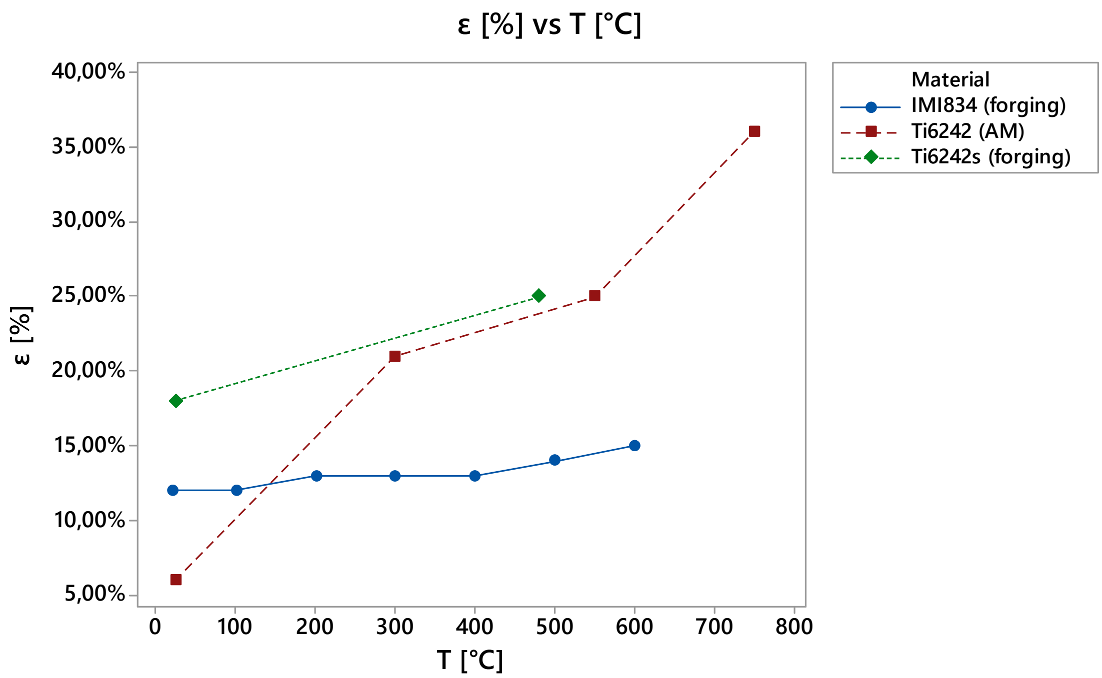

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