



Air Force Research Laboratory | AFRL

Science and Technology for Tomorrow's Air and Space Force

Materials and Manufacturing Directorate

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New Titanium Alloy Will Increase Performance and Reduce Weight of Race Cars

Many components used in auto racing demand a material that can handle very high stress and temperature requirements. Scientists and engineers at the Air Force Research Laboratory Materials and Manufacturing Directorate are working to develop and transition a new titanium alloy that has high strength and stiffness and also low density that will fulfill Air Force needs in aerospace and space structures, engine components, and spacecraft components. Due to the similarity of requirements for high performance automotive applications and Air Force aerospace needs, collaborative work is advantageous to all parties.

The class of titanium alloys being developed by the Air Force is called Ti-B. In this class of alloy, additions of boron lead to exceptional mechanical properties and extended use temperatures. The added boron develops small reinforcements that, when added to Ti-6-4 for example, increase the strength of the alloy by 40 percent and the stiffness of the alloy by 30 percent, while maintaining good ductility.

Work on Ti-B alloys by Toyota has led to successful transition to the commercial market. Toyota has transitioned this material to intake and exhaust valves in one of their Asian market vehicles, the Altezza. These valves are the standard production component with over 500,000 parts in-service and no reported failures. Replacement of steel valves resulted in nearly one pound of reciprocating mass saved per engine.

Collaborative efforts are currently underway between the Air Force and an automotive company to examine the feasibility of using a Ti-B alloy for an application in a performance racing car. The collaborative work will focus on the processing required to produce the component with the desired properties. The increased stiffness of the Ti-B alloy should provide a large performance benefit over the conventional titanium alloy part.



A valve made with a titanium alloy.

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