

Summer Research Program 2011/2012

Reducing the buy-to-fly ratio of titanium: understanding the high temperature deformation of titanium alloys

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Objective

The aim of this project is investigate the deformation of titanium alloys at elevated temperature.

Description

Titanium alloys are conventionally thought of as a material that is used in demanding applications when cost is not the primary issue in selecting a material. Examples of these applications include aerospace components and medical devices. However, it is estimated that for every 10kg of titanium alloy purchased by the manufacturer only 1kg finds its way to the finished component. Recent research has been directed at reducing the cost of manufacture by as much as 50%, and this not only opens up a broader market for the metal but also pushes current usage to be more efficient. As part of this cost reduction we need to understand the deformation behaviour of titanium alloys so that manufacture and use of the metal can be optimized.

Titanium alloys often contain a hexagonal-close-packed alpha phase and a body-centred-cubic beta phase. The titanium alloys Ti-6Al-4V and Ti-10V-2Fe-3Al are two of the most commonly used titanium alloy in commercial applications, but surprisingly little is known about the deformation of the bcc beta phase in these alloys, or of the deformation of the alloys close to or above the beta transus. The project will examine the deformation of beta-containing titanium alloys over a range of temperatures, strain rates, and strains and will correlate this with crystallographic texture and simple analytical models of mechanical behaviour that combine the deformation of the two phases in a manner similar to composite models.

Pre-requisites: The successful applicant will have a good understanding of the mechanical behaviour of metals and be willing to undertake experimental deformation studies.