

Editorial

Titanium Alloys

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Received: 11 August 2015 / Accepted: 11 August 2015 / Published: 14 August 2015

Although originally discovered in the 18th century [1], the titanium industry did not experience any significant advancement until the middle of the 20th century through the development of the gas turbine engine [2]. Since then, the aerospace sector has dominated worldwide titanium use with applications in both engines and airframe structures [3]. The highly desirable combination of properties, which include excellent corrosion resistance, favourable strength to weight ratios, and an impressive resistance to fatigue, has led to an extensive range of applications [4], with only high extraction and processing costs still restricting further implementation.

Whilst the aerospace industry faces challenges related to increasing operating temperatures and to fully utilise polymer-based composites in future designs [5], innovative solutions, including metal matrix composites and titanium aluminides, provide pathways for future development. Furthermore, improvements in extractive metallurgy and processing methods have made titanium-based alloys more accessible to alternative industrial sectors. Industries currently utilising these materials include sports, biomedical, and marine sectors [6].

As more traditional applications are supplemented by exciting new opportunities, it is clear that extensive research opportunities are likely to exist in the titanium industry for the foreseeable future.

The Present Issue

It is my pleasure to act as Guest Editor for the thematic issue of “Titanium Alloys” in *Metals*. The journal continues to go from strength to strength with an Impact Factor of 0.883 in 2014. The ongoing interest in titanium alloys is reflected in the quality and variety of the papers in this Special Issue, which includes contributions on processing, machining, mechanical properties, composites, and surface treatments, along with insights into medical applications.

Indeed, the papers published in the Special Issue cover a diverse range of engineering fields which are linked by the material. Papers by Maussaoui *et al.* [7] and Nouari *et al.* [8] provide significant contributions in the field of machining of titanium alloys. The work by Nouari provides an excellent in depth study of the fundamental factors which influence machinability of two alloys, the more

traditional Ti-6Al-4V along with the more recent near β alloy Ti-5Al-5Mo-5V-3Cr-1Zr. Maussaoui's work then goes on to quantify the effect of milling/surface finish on fatigue life with an optimised machining plan suggested. A further paper by Lisiecki [9] promotes an alternative approach to the issue by accepting that titanium and its alloys have poor tribological properties and seeks to address this through gas nitrided surface coatings. The paper by Du *et al.* [10] focuses on flow behaviour during isothermal compression and, in particular, microstructural evolution supported by high quality electron back scattered diffraction work.

The remaining three papers are more application focussed with the work by Kotte [11] addressing the requirement for titanium alloys to be used as joining parts to light weight materials, such as aluminium and fibre reinforced plastics in the aerospace industry, whereas the work by Han [12] and a review paper by Petersen [13] relate to critical requirements in medical-based applications. Both papers are informative regarding the use of titanium alloys for orthopaedic and dental implant applications, featuring up to date issues and offering potential future solutions.

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