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Editorial

Titanium Alloys 2017

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1. Introduction and Scope

Although titanium was originally discovered in the 18th century [1], significant developments in the titanium industry only occurred in the middle of the 20th century. These changes resulted from the emergence of the gas turbine engine and led to the development of industries focussing on titanium sponge production in USA, Europe, and Japan [2]. Since that time, the aerospace sector has dominated the titanium use worldwide. The metal has applications in both engines and airframe structures. Titanium has a highly desirable combination of properties, which include excellent corrosion resistance, a high strength-to-weight ratio, and good fatigue resistance. Such qualities enable extensive applications, and only its high extraction and processing costs restrict further implementation.

Although the aerospace industry faces challenges related to increasing operating temperatures and the development of polymer-based composites, 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 industries. Industries currently utilising these materials include the sports, biomedical, and marine sectors.

2. Contributions

As part of this Special Issue, I am delighted to present a collection of high-quality papers which cover a range of topics from the extensive field of titanium alloys, including processing, mechanical properties, microstructural evolution, titanium-based composites, and titanium aluminides. The paper by Yu et al. [3] provides an insight into the possibilities of isothermal atmospheric sintering of commercially pure titanium powders, generating satisfactory mechanical properties. A second paper by the authors continues the theme of sintered titanium powders, this time investigating the microstructural evolution of Ti–Al–V–Fe alloys [4]. Titanium-based composites, also produced by a vacuum sintering process, have also found an application in the rapidly developing field of additive manufacturing, and the paper by Korosteleva et al. [5] is an interesting investigation into the latest development of these materials. Similarly, titanium boride-based composites as heat insulating materials are an example of a material with a more unique application [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. Currently, an active area of research regards titanium aluminides, where the difficulties of these low-ductility materials are offset by their potential for weight saving and higher-temperature operation. The interesting work by Wang et al. [7] relating microstructure and mechanical properties is a welcome addition to this compilation.

The more traditional areas of research into microstructure and mechanical properties of titanium alloys, however, continue to provide fascinating and industrially relevant research. Processing parameters and their effect on microstructure is a focus of the work presented by Wu et al. [8], and structure evolution is also considered in the work by Fan et al. [9]. It is always fascinating to see papers in an area of my

own previous research interest, namely, the mechanical properties of titanium alloys, and the paper by Sun et al. [10] aptly describes the effects of hybrid reinforcements on a titanium alloy. Similarly, the work by Ba et al. [11] examines the effect of silicon addition on both microstructure and tensile properties and provides an interesting read, as does the work by Chang on CP titanium [12]. Fretting and wear behaviour is an important application-based topic and is currently being actively researched in titanium alloys, as evidenced here by the papers by Mi et al. [13] and He et al. [14].

The titanium industry faces many challenges in the modern world, but the flexibility of the material and its ability to adapt to an ever-widening range of industrial applications illustrates the broad scope of opportunities for continuing research. It is my hope that this collection of papers indicates the strength and continuing diversity of titanium alloys and provides a valuable addition to an already comprehensive field of research.

Conflicts of Interest: The author declares no conflict of interest.

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