論文の要旨

題名 Preparation and characterization of in-situ graphite powder reinforced titanium-based composites

（In-Situ 黒鉛粉末強化チタン基複合材料の組織制御及びその特性評価）

氏名 WANG NING

Titanium matrix composites (TMCs) have excellent mechanical properties, corrosion resistance, and relatively low density, making them important materials for structural applications in aerospace, defense, automotive, and many other industries. However, their inadequate elastic modulus, hardness and wear resistance limit their wider application. To overcome these shortcomings, the introduction of strong ceramic phase to manufacture TMCs is an effective strategy. TiC has been extensively investigated because of its excellent mechanical properties (especially high strength, high hardness and high modulus).

Chapter 1 introduces the structure of TiC and the classification and preparation methods of TMCs and provides a review of the development of advanced TMCs. The requirements properties of TMCs and the problems of the existed TMCs were also discussed.

Chapter 2 the microstructure evolution during the fabrication of in situ TiC reinforced TMCs has been investigated. By observing the structure of the produced composite material, the state of dispersion of the base metal structure and reinforcing material have been investigated in this chapter.

Chapter 3 ultra-thin graphite powder sheets made of graphite powder and PVA were used as a carbon source for the laminated sintering. In addition, the microstructural evolution during the fabrication of in-situ TiC-reinforced TMCs was investigated with a particular focus on the formation mechanism of rod-like TiC particles. Tensile tests were carried out as an assessment of the mechanical properties.

In Chapter 4, our primary objective is to ensure a comprehensive in-situ reaction and uniform distribution of reinforcement within Ti/C composites containing varying carbon contents. We achieve this by employing ultra-thin graphite powder sheets as the carbon source and pure titanium foil as the titanium matrix through a layer-stacked sintering method. Additionally, the effects of carbon content on the morphology of the reinforcement, the evolution of the microstructure of the matrix and the mechanical properties of the composites were systematically investigated through composition design and process optimization.

As last, the results from the above-mentioned studies are summarized in Chapter 5.