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# Microstructural characteristics and formation mechanism of laser cladding of titanium alloys on carbon fiber reinforced thermoplastics

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**Abstract:** TC4 coating was successfully prepared on the surface of carbon fiber reinforced thermoplastics (CFRP) via laser cladding technology. The microstructure of the TC4 coating/CFRP substrate interface was analyzed. The results indicated that the molten TC4 infiltrated into the CFRP substrate and reliable bonding of TC4 coating and CFRP substrate was obtained. TiC and a small amount of TiS<sub>2</sub> phases were formed at the interface between TC4 coating and CFRP substrate. In addition, the process for preparing TC4 coating on the surface of CFRP substrate and the bonding mechanism at the interface was put forward based on the basis of experimental observation and theoretical analysis.

**Keywords:** CFRP, Surfaces, Laser cladding, Microstructure, Bonding mechanism

## 1. Introduction

Carbon fiber reinforced thermoplastics (CFRP) have many unique advantages such as high specific strength, good designability, adequate fatigue fracture resistance and special electromagnetic properties [1]. However, the low operational temperature, poor electrical conductivity, and potential flammability may limit their application in aerospace, marine, rail industry sector and other industries. The metallic coating on the surface of CFRP can effectively improve the mechanical, thermal, electrical properties and service life of CFRP, consequently satisfying the functional and protective requirements of CFRP structural parts [2]. Hence, the preparation of metallic coatings on CFRP by the deposition technology has attracted much attention.

The methods of preparing metallic coatings on the surface of CFRP or resin materials mainly include physical vapor deposition (PVD) [3], chemical vapor deposition (CVD) [4], plasma enhanced chemical vapor deposition (PECVD) [5] and spraying technology [6]. Although these methods can be applicable for fabricating thermoplastic structures, the high cost hinder their wider applications. Besides, the bonding between coating particles is dominated by a mechanical

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