

## Remarkable Enhancement in Corrosion Resistance of Selective Laser Melted Ti-6Al-4V Alloy by Femtosecond Laser Surface Processing

Jinpeng Fang<sup>1</sup>, **Nianwei Dai**<sup>2,3,\*</sup>, Yachao Zhang<sup>1</sup>, Sizhu Wu<sup>1</sup>, Lai-Chang Zhang<sup>4,\*</sup>

<sup>1</sup>*School of Instrument Science and Opto–Electronics Engineering, Hefei University of Technology, Hefei 230009, China*

<sup>2</sup>*Shanghai Institute of Applied Physics, Chinese Academy of Sciences, Shanghai 201800, China*

<sup>3</sup>*CAS Key Laboratory of Mechanical Behavior and Design of Materials, Department of Precision Machinery and Precision Instrumentation, University of Science and Technology of China, Hefei, Anhui 230027, China*

<sup>4</sup>*School of Engineering, Edith Cowan University, 270 Joondalup Drive, Joondalup, Perth, WA 6027, Australia*

[dainianwei@sinap.ac.cn](mailto:dainianwei@sinap.ac.cn)

**Abstract** The corrosion resistance of selective laser melted (SLMed) Ti-6Al-4V (TC4) alloys has been improved by means of femtosecond (fs) laser surface processing (FLSP). FLSP with lower laser powers (< 300 mW) creates a uniform layer of periodic nanostructure on the sample surface, while the hierarchical micro/nanostructures are induced under the higher power (>400 mW). The electrochemical results reveal that the corrosion resistance of the SLMed TC4 sample in Cl<sup>-</sup> environment is improved after FLSP treatment. More surprisingly, the FLSP treated alloys exhibit a continuously increasing in corrosion resistance with further exposure to air. The chemical immersion results also indicate that the localized corrosion damage of SLMed TC4 alloys is suppressed after the FLSP treatment. The detailed XPS results show that the FLSP primarily induces the formation of Ti<sup>4+</sup> and Ti<sup>2+</sup> oxidation states on sample surfaces. With the extension of exposure to air, the proportion of Ti<sup>4+</sup> on the entire surface evidently increases due to the accelerated oxidation process on FLSP-induced nanostructures. The FLSP induced micro/nanostructure plays a crucial role in continuously yielding a protective oxide film, correspondingly enhancing the corrosion resistance property of SLMed TC4 alloys with further exposure.

**Keywords** Femtosecond laser surface processing, SLM Ti-6Al-4V, Corrosion resistance, Micro/nanostructure, Protective film, Air exposure

## Reference

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