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Optical properties of laser induced oxynitride films on titanium

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Highlights

- !! The optical properties of laser-induced films on titanium were studied.
- !! The thickness of the oxide films (20÷40 nm) increased linearly with the fluence.
- !! The oxynitrides in the scales formed on titanium have been found.
- !! We found an absorption band in the visible-light wavelength range.
- !! It follows that the color formation results from interference and absorption.

Abstract

This paper presents a study of the optical properties and chemical composition of laser-induced color oxynitride films formed on titanium substrates in a normal-pressure atmospheric environment. The samples were investigated by spectroscopic ellipsometry and X-ray photoelectron spectroscopy. The influence of the laser fluence F on the optical properties of oxynitride films has been found. The thickness of the layers ranges from ~ 20 nm to ~ 40 nm and increases linearly with F . The determined complex dielectric functions demonstrate two absorption bands, one of them appears in the visible-light wavelength range. We show that the color created by oxynitride films formed on the titanium surface depends not only on the interference effect as commonly assumed, but is also a function of the changes of the optical properties of these coatings.

Keywords: laser color marking, titanium, titanium oxides, colorimetry, CIE $L^*a^*b^*$, color, fiber laser, dielectric function, spectroscopic ellipsometry

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Introduction

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