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A comparative study for surface texture evaluation of TiAlN coatings

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Abstract

This paper explores the relevant 3D roughness parameters used to characterize surface texture of titanium (Ti) based coatings. The main objective of this study was to compare the surface texture parameters, and to obtain 3D topographies of surface roughness. The applied surface analysis in areal manner allows a more complete evaluation of the component part surface and coating properties. This comparative study identified the areas for further consideration.

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Keywords: TiAlN coatings; surface texture; roughness;

1. Introduction

Industrial usage of titanium can be roughly dated back to the late forties of the past century. Aerospace industry has been the driving sector behind titanium exploitation from since on. An approach when a durable coating is applied on the material surface is becoming more used. Application of coatings could improve operation of equipment and their constructive parts, and thus protect them from the negative environmental influence (e.g., extreme high temperatures). Titanium finds wide usage as a coating component due to its characteristic property of combining into hard compounds [1]. Research into surface texture measurement and characterization has been carried out for over a century and is still very active [2].

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2. Experimental Study

In this experimental study, the surface texture of two titanium aluminum nitride (TiAlN) coatings for aerospace industry applications were compared. The substrate materials were different for each sample, but the chemical composition of both evaluated coatings was the same. The TiAlN coating was deposited on a glass surface for sample C1 while the coating of sample C2 was deposited on a blade that made of titanium alloy and used in gas turbine engine. A deposition method and technological mode was equal for both sample types.

In order to obtain the information on possible functional properties of the surface it is important to conduct the metrological analysis which includes the taking of surface roughness topography and its filtering, and the determination of roughness parameters. For the task execution there was used measuring equipment – profilometer "Taylor-Hobson Talysurf Intra 50", which provides an accurate measurement of surface roughness parameters. The given profilometer is equipped with a block of electronic system for data receiving, drive, measuring table and measuring arm with a diamond stylus. Information from the measuring equipment is transferred to the computer, which performs all the necessary processing of data.

In this work the measuring experiment was carried out for two samples C1 and C2. The specimens after cleansing with cleansing agent from grease and dirt were placed on the measuring table. To begin an experiment, at first it was necessary to set the parameters, which characterize the measurement area of the samples, the number of points and the rate of movement of stylus (Table 1).

Table 1. The settings of experiment.

Parameter	Unit
Stylus	Standard Stylus Arm 112/2009
Number of points (Y)	500
Data length (Y)	1,5 mm
Number of points (X)	500
Data length (X)	1,5 mm
Measurement Speed	0,5mm/s

While the measuring experiment was running, the stylus was moving in X and Y directions thus forming a three-dimensional image of the surface. The measuring process is shown in Figure1.

a b

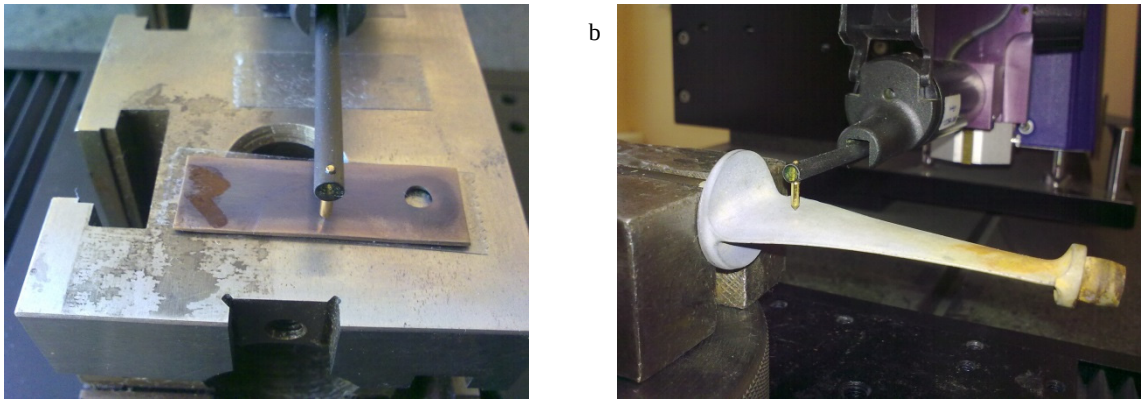

Fig. 1. (a) the sample C1; (b) the sample C2.

The next step in this experiment was to obtain 3D image of roughness. For the purpose to get a real roughness values, the obtained images were processed using "μultra" software, because, as is known [2,3], the primary surface topography comprises form errors and waviness. Within the experiment it was performed the surface levelling, form