Anton Paar

Stainless Steel Surface Roughness by AFM

Keywords:

atomic force microscopy, stainless steel, surface morphology, surface roughness

1 Introduction

Surface roughness is a key factor for corrosion resistance in stainless steel, and products must conform to the European standard.[1] Atomic force microscopy (AFM) is a convenient way to analyze stainless steel surfaces and characterize the surface roughness according to ISO 25178. In this report, three samples are analyzed by using Tosca™ 400 – the new AFM from Anton Paar.

2 Experimental

Three stainless steel 1.6582 samples polished to different roughness levels were imaged using Tosca™ 400 in tapping mode at ambient conditions. Several positions were measured for each sample to calculate an average surface roughness by using the root mean square of the height, according to ISO 25178. All acquired images are 30 x 30 µm.

3 Results and Discussion

Sample (a) has the lowest roughness (15 nm), as can be seen in Fig. 1, where dense linear polishing grooves can be clearly observed. Sample (c) has the highest roughness (381 nm). Linear polishing grooves are also seen but are much deeper and wider than those in sample (a). Sample (b) has a roughness of 84 nm. It shows linear polishing grooves but with some defects which need to be further investigated.

Compared to a 2D surface roughness tester, AFM not only measures the surface roughness but also displays a 3D image (Fig. 2, over page) showing the surface morphology of the measured area and disclosing the possible defects at micro and nano scales.

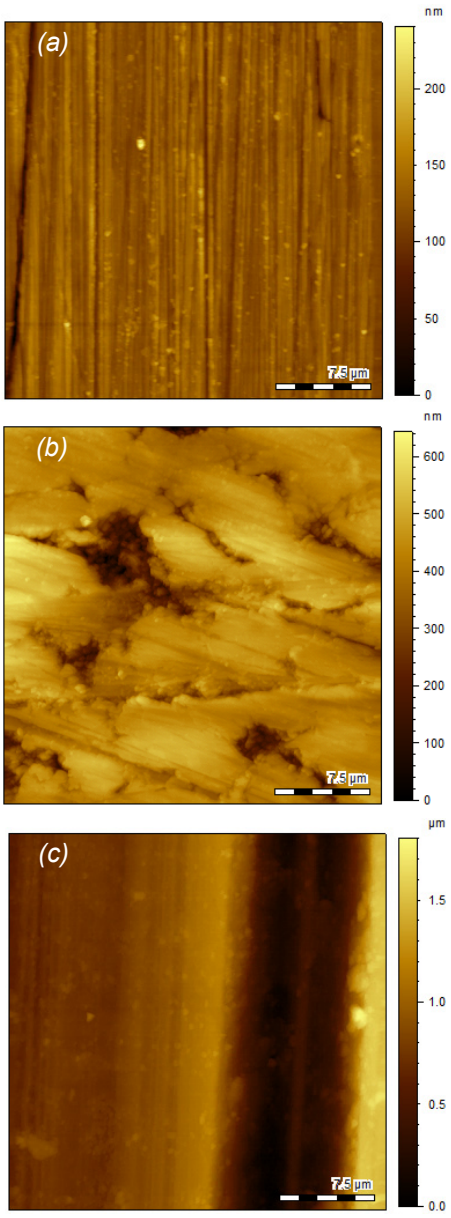

Fig. 1 Surface topography of 3 stainless-steel samples polished to different roughness levels (a) 15 nm, (b) 84 nm and (c) 381 nm

4 Summary

We have successfully characterized different stainless steel samples using Tosca™ 400. Surface roughness has been calculated and the possible defects have been detected. It provides steel industry as well as other metal industries a quantitative method to measure the surface roughness following ISO 25178 and observe the 3D surface morphology simultaneously.

5 References

[1] C. Honess and A. Harrison, The Importance of Surface Finish in the Design of Stainless Steel, 2006, www.bssa.org.uk/cms/File/surfacefinishbssaVer2.pdf (accessed 15.11.2016)

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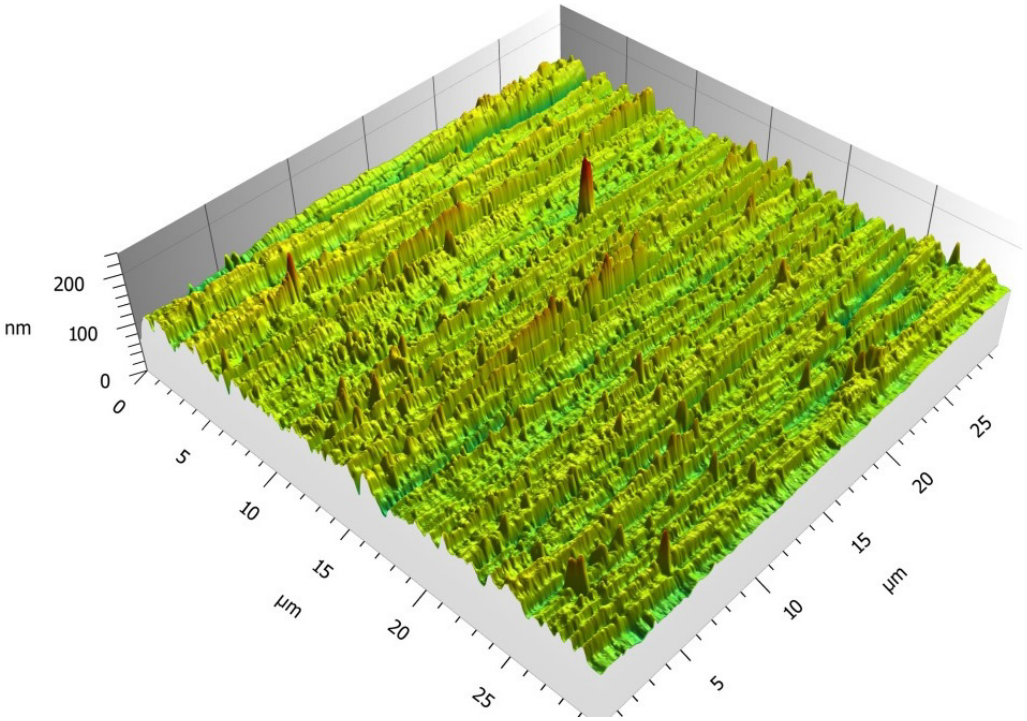

Fig. 2 : 3D view of sample (a)