Primjena AFM u karakterizaciji promjena na površini modificiranih vlakana

Application of AFM for characterization of surface changes on modified fibres

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INTRODUCTION

The identification and characterisation of morphological structure and fibre surface topography peculiarities after plasma treatment are therefore an important issue when investigating the possibility of targeting textile material modifications using plasma and nanoparticles[1,2]. Atomic force microscopy (AFM)[3,4] has been used to characterise the changed micromorphology of the fibre surface layers and textile substrate. The emphasis in this investigation is given to the specific opportunities offered by the AFM technique to characterise the complex morphology of the textile surface after plasma treatments, as well as on defining the impacts of these changes on the obtained final properties of textile materials treated in this way.

[1] R. Shishoo: Plasma technologies for textiles, Published by Woodhead Publising Limited in association with The Textile Institute, Abington Hall, Abington, Cambridge, England, 2007.
[2] S. Ercegović Ražić and R. Čunko: Properties modifications of textiles using plasma, *Tekstil* 2009, **58** (3), 55-74.
[3] S. Eun-Deock: Atomic Force Microscopy and Specular Reflectance Infrared Spectroscopic Studies of the Surface Structure of Polypropylene Treated with Argon and Oxygen Plasmas, Macromolecular Research, 2004, **12** (6), 608-614.
[4] R. Wiesendanger: Scanning Probe Microscopy and Spectroscopy, Methods and Application, Cambridge University Press, 1994, Cambridge.

AIM

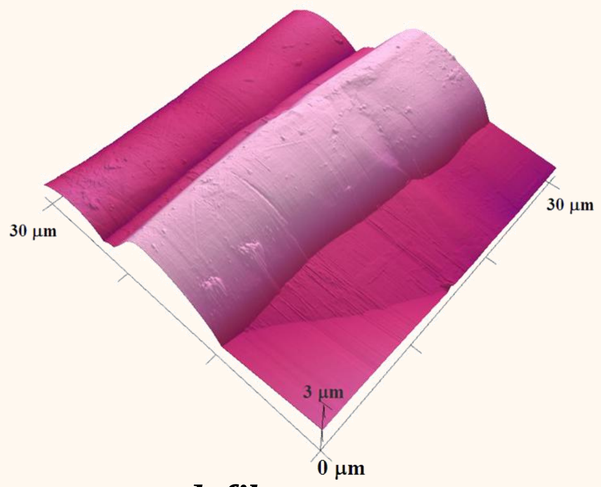
The aim of the present study was to investigate the morphology and topography of surface roughness caused by oxygen and argon plasma treatment as well as the size and distribution of silver nanoparticles in textile samples after treatment by plasma and silver compounds by atomic force microscopy. Obtained results were compared with those obtained by investigating the untreated sample.

CONCLUSIONS

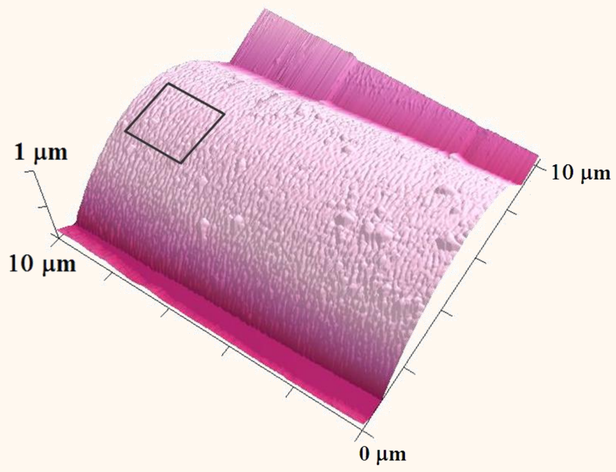
AFM is unique and totally acceptable technique for investigation of superfine textile surface changes at nano level, in ambient conditions and without any destruction of observed samples. Investigations of textile sample surfaces after different plasma treatments with AFM represent very important step for better understanding, monitoring and conclusions on matter of plasma treatment mechanisms and their effects on material properties. It was confirmed that the plasma treatment can be a very acceptable method of textile surface modification without fibre damage and at the same time eco-friendly method.

AFM IMAGING OF LYOCELL FIBRES

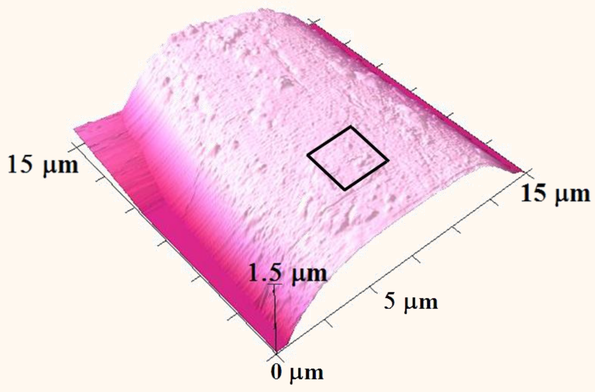
Untreated fibre



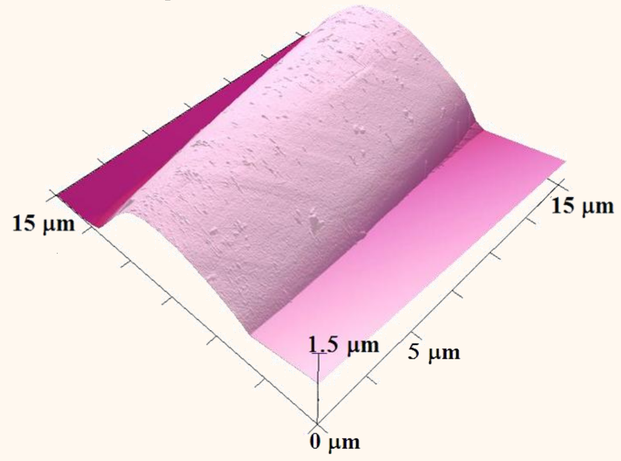
Treated fibre with $AgNO_3$ solution by PE-CVD process

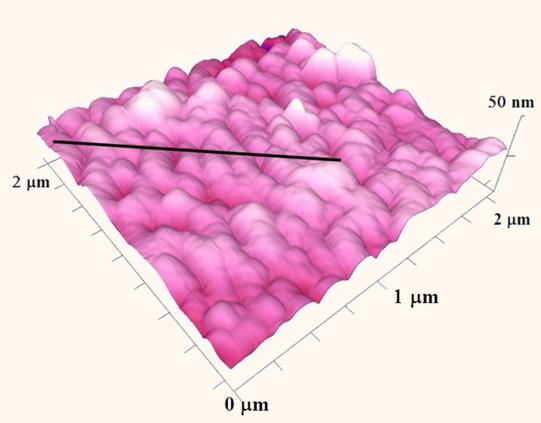


Treated fibre with AgCl dispersion by PDP process

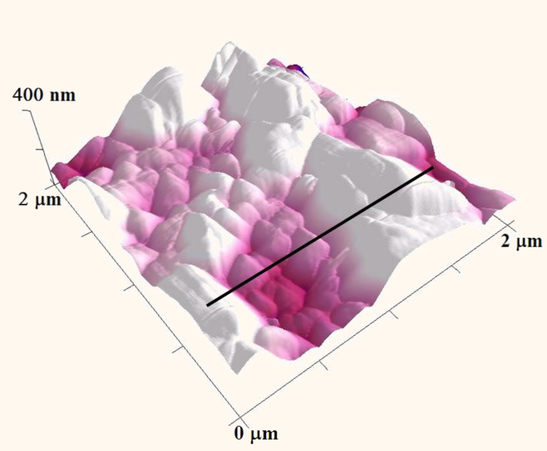


Oxygen plasma treated fibre

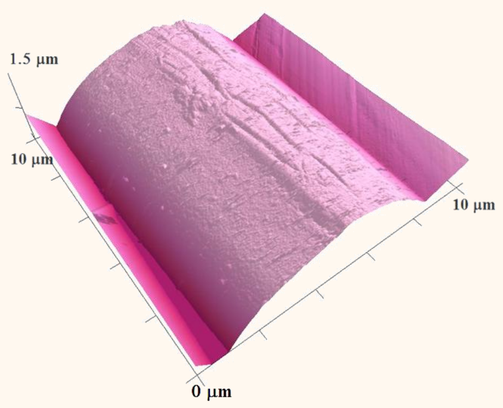




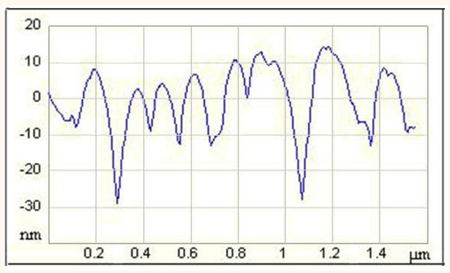
Zoom in



Argon plasma treated fibre



Section Analysis



MATERIALS AND METHOD

Materials

The textile substrate used was a Lyocell fabric of the defined structural characteristics.The coarse fabric was desized and scoured according to the industrial process conditions prescribed before undergoing plasma treatments.

AFM measurements

Instrument: Nanoscope IIIa controller (Bruker, Billerica USA) with a vertical engagement (JV) 125 mm scanner. Contact mode imaging was performed using silicon nitride tips (NP, Bruker, USA, Nom. Freq. 56 kHz; Nom. spring const. 0.24 N/m) Processing and analysis of images were carried out using the NanoScope software (Digital Instruments, version V614r1).
Samples of individual Lyocell fabric (1 cm^2) were fixed on the sample holder (stainless steel, diameter of 11 mm) immediately before testing. All the measurements were performed in contact mode under ambient conditions, i.e. at room temperature and at relative air humidity of 50–60%.
The morphology of lyocell fabric is presented as three-dimensional view of height data and as vertical profiles along indicated lines (Section analysis).