Cross-sectioning nanofibers and detecting additives

Adéla Kotzianová
Ondřej Židek
Jan Klemeš
Marek Pokorný

Contipro a.s., Dolní Dobrouč 401, Dolní Dobrouč, Czech Republic

kotzianova@contipro.com

Abstract

The nanofibrous structures are widely researched nowadays in various fields - from electronics to medicine or pharmacy. Properties of synthetic or natural polymers used for electrospinning are often enhanced with additives or carry drugs or other active substances [1, 2]. But there are not many ways how to study distribution of the additives inside these fibers with diameter smaller than 1000 nm. The transmission electron microscopy could be used, but it does not determine whether the additives are on the surface or inside fibers. In this work we use the not so much used alternative - the ion beam slope cutting method to cut nanofibrous layers and make its cross-section available for further analysis. This slope cutting method is quite widely used in the field of metals analysis [3] and it is very promising also in the field of polymers, where it is used very rarely especially for nanofibers. Unfortunately, unlike the metals, the polymers behave very differently. Their specific behaviour requires a specific approach to perform the slope cutting. In this work we discussed the effects of various parameters of the ion slope cutting process on the nanofibrous layers. We also defined the best conditions of cutting process and the best way how to prepare a sample for ion cutting. Moreover, we used the energy dispersive X-ray spectroscopy to map cross-sections of our fibers and thus show distribution of additives.

References

[1] Pham QP et al., Tissue engineering, 12 (2006), 1197-1211.

[2] Jung JW et al., Journal of Materials Chemistry A, 4(2016), 703-750.

[3] Besserer HB et al., Microscopy research and technique, 4 (2016) 321-327.

Figures

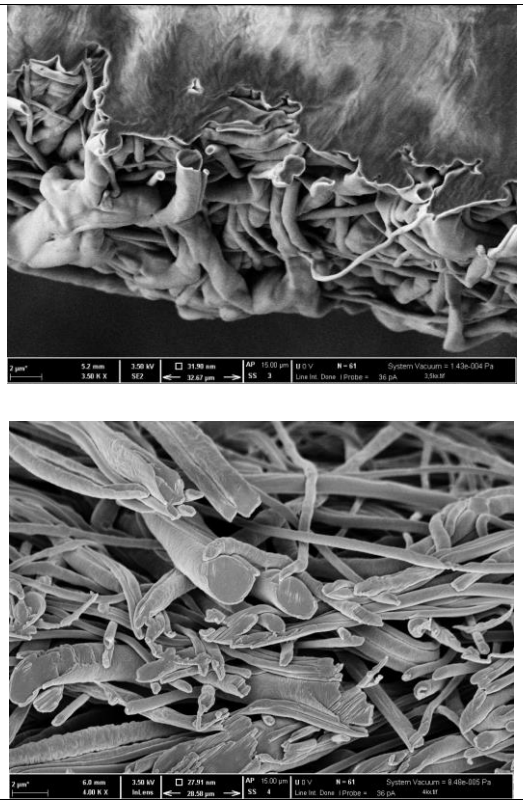

Figure 1: The cross-sections of the two polycaprolactone nanofibrous layers from a same sample cut under different conditions of the ion beam slope cutting method.

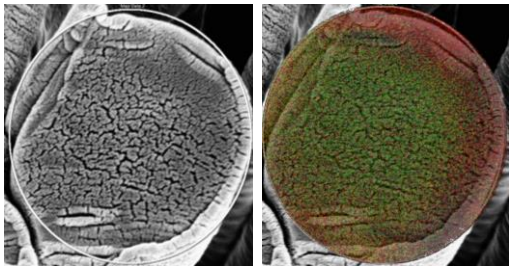

Figure 2: The cross-section of a single fiber with a the EDX mapping of carbon (red) as a polycaprolactone marker and bromine (green) as an additive marker.