Investigating in-situ the formation of biofibre-metal nanocomposites with GISAXS

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The reduction of structural sizes for many sensor-type devices based on nanocomposite materials creates a need for investigating the nanocomposite's structure in such a restricted geometry [1]. Typically, these devices display a flat geometry. However, e.g. nanowires, smoothed edges, channels, or wire-like connectors represent a fiber like structure and are equally important as charge-collecting components. Hence, it is important to explore routes, during which metal is deposited on curved surfaces, especially polymeric and biological fibers. In our experiments presented here we extended the investigations of metal-polymer nanocomposites thus in two ways. First we describe a way to characterize the substrate - the fiber or the channel - using a combination of nanofocused beam and grazing incidence small-angle x-ray scattering (GISAXS) [2]. We show that we are able follow the topography of the metal layer through the cross-section of a polymeric channel, without the need of special sample preparation. Secondly, we explore in-situ the self-assembly of metal nanoparticles on biopolymeric fibers using GISAXS in combination with in-situ sputter deposition [3]. This fiber-metal nanocomposite acts as a model system for many industrial applications, like anti-counterfeiting and cosmetic products, as well.

[1] M. Wolkenhauer et al., Appl. Phys. Lett 89, 054101 (2006)
[2] S. V. Roth et al., Appl. Phys. Lett. 91, 091915 (2007)
[3] E. Metwalli et al., Langmuir 24, 4265 (2008)

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