Multiscale structural decoding of fibrous materials by SAXS and WAXD

Anjani K. Maurya, Alex Dommann, and Antonia Neels

Empa, Swiss Federal Laboratories for Materials Science and Technology, Center for X-Ray Analytics, St. Gallen CH-9014, Switzerland

Most of the natural or fabricated fibrous materials exhibit multiscale structures, which critically influence their mechanical, optical, and electronic properties. Therefore, knowing the structure is important to steer the properties or design novel fibrous material. This requires multiscale structural characterization to enrich their structure-properties relationship. State-of-the-art small-angle X-ray scattering (SAXS) and wide-angle X-ray diffraction (WAXD) techniques are extremely powerful to characterize such materials from the nanometer to the Ångström scale [1].

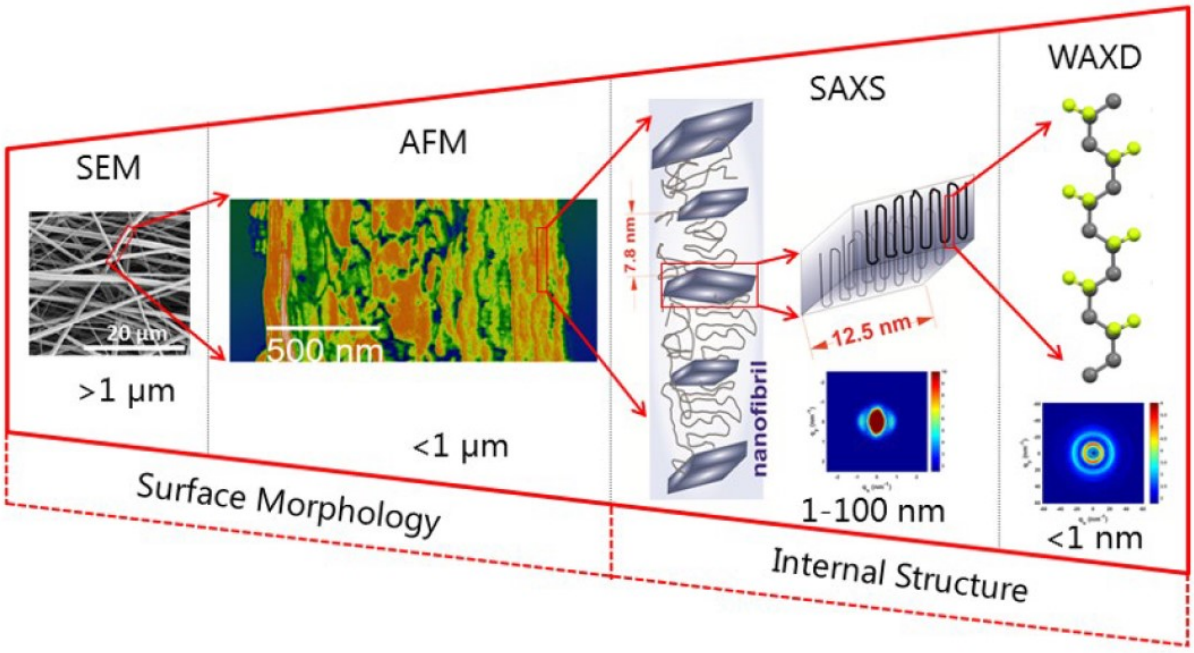

Figure 1. Schematic of the multiscale structure of electrospun scaffolds [1].

In this contribution, multiscale structural insights of different fibrous materials such as electrospun nanofiber scaffolds [1], thermal protective fabrics [2], and fibrous biocomposite tissues would be presented with emphasis on their structure-properties relationship primarily using SAXS and WAXD methods. The schematic of the multiscale structure of the electrospun nanofiber scaffolds is shown in figure 1 as an example. Furthermore, the application of gained structural knowledge to steer the properties of polymeric nanofibers and the design of novel humid responsive nanofibrous scaffolds would be discussed.

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[2] A.K. Maurya, S. Mandal, D.E. Wheeldon, J. Schoeller, M. Schmid, S. Annaheim, M. Camenzind, G. Fortunato, A. Dommann, A. Neels, A. Sadeghpour, R.M. Rossi, Effect of radiant heat exposure on structure and mechanical properties of thermal protective fabrics, Polymer 222 (2021) 123634.

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