

Structure investigations of oriented systems at nanoscale

Cristiano Luis Pinto de Oliveira

Institute of Physics, University of São Paulo.

Abstract: The investigation of systems at nanoscale is very important to understand the system structure and the mechanisms associated with the interplay of structure, function and dynamics. In this way, depending on the characteristic that want to be evaluated, an appropriate experimental method has to be used.

Scattering methods, in particular Small-angle X-ray Scattering, are very suitable for the investigation of structures at nanoscale since one can obtain structural information from the internal structure of the system. In general, SAXS is a simple transmission experiment where the X-ray beam passes through the sample, interacts with the electron clouds from the atoms and scatters. From the obtained scattering patterns one can obtain structural information from the investigated system [1].

If the particles in the system are randomly oriented, the obtained 2D scattering pattern is independent of the azimuthal angle and therefore one can integrate the full image in a single 1D curve. However, if the particles show orientations the obtained 2D scattering patterns shows anisotropies [2].

In this talk, scattering results from oriented liquid crystals [3] and hair fibers will be presented [4]. As it will be shown, a large number of structural parameters can be obtained from the data analysis and can be correlated to other experimental data.

Key-words: nanostructures, small-angle x-ray scattering, SAXS, liquid crystals, hair fibers

Support: This work has been supported by FAPESP, INCT-FCx

References:

- [1] Oliveira, C.L.P., Investigating Macromolecular Complexes in Solution by Small Angle X-Ray Scattering, in Current Trends in X-Ray Crystallography, D.A. Chandrasekaran, Editor. 2011, InTech. p. 367-392.
- [2] Alves, C., J.S. Pedersen, and C.L.P. Oliveira, Calculation of two-dimensional scattering patterns for oriented systems. Journal of Applied Crystallography, 2017. 50(3): p. 840-850.
- [3] Santos, O.R., et al., Structure and local order of lyotropic cholesteric calamitic phases: The effect of the chiral molecule. Journal of Molecular Liquids, 2022. 349.
- [4] Lima, C., et al., Human hair: subtle change in the thioester groups dynamics observed by combining neutron scattering, X-ray diffraction and thermal analysis. European Physical Journal-Special Topics, 2020. 229(17-18): p. 2825-2832.