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Zooming in on multiscale polymer composites by (S)TEM

Abstract. The design and chemical synthesis of polymer composites with advanced (multi)-functional properties is a major focus of materials research. To understand and optimize the processes that underlie the formation of polymer composites, quantitative analysis of structures and their formation paths over multiple length and time scales is required. In our work we frequently employ (time-resolved) sample preparation with multiscale (cryogenic) (S)TEM and cryo electron tomography to facilitate this task.

This presentation will introduce the technical requirements of multiscale electron microscopy and highlight the opportunities that arise for polymer research [1-3]. Examples will include the formation of polymer assemblies in suspension [4]; conductive networks in graphene/polymer [5] or carbon nanotube/polymer [6] composites; and multiscale analysis of beam sensitive composite materials [7]. Furthermore it will be shown how to obtain quantitative information by image analysis, and how this aids in determining (self)-organization pathways or structure-property relationships on all relevant length and time scales.

- [1] J. Patterson, H. Friedrich et al. *Acc. Chem. Res.* 50 (2017) 1495–1501.
- [2] J. Evans and H. Friedrich *MRS bulletin* 41 (2016) 516-521.
- [3] H. Friedrich et al. *Angew. Chem. Int.-Ed.* 49 (2010) 7850-7858.
- [4] B. McKenzie, H. Friedrich, N. Sommerdijk et al. *Soft Matter* 12 (2016) 4113 - 4122.
- [5] K. Arapov, H. Friedrich et al. *Adv. Funct. Mater* 26 (2016) 586–593.
- [6] K. Gnanasekaran, H. Friedrich et al. *J. Phys. Chem. C* 120 (2016) 27618–27627.
- [7] K. Gnanasekaran, H. Friedrich et al. *Ultramicroscopy* 160 (2016) 130–139.