Neutron Imaging

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The scope of imaging has changed significantly in recent years. The spatial resolution has improved continuously and significantly within the last decades and overlap with the resolved size range with advanced scattering techniques is achieved. However, also the focus of imaging has shifted from being a visual inspection technique in non-destructive testing (NDT) to being a quantitative scientific tool. In particular, neutron imaging has developed to exploit microscopic structural information probed by elastic scattering apart from the conventional macroscopic real space resolution through a number of advanced imaging methods probing real and reciprocal space simultaneously. While the main difference between imaging and scattering might be the exploitation of information achieved in real space on individual macroscopic structures and in reciprocal space on statistical microscopic structures, respectively, these limits and distinctions start to vanish in modern neutron imaging. Different modalities of dark-field imaging allow observing small-angle scattering features combined with image resolution and the exploitation of Bragg edges and extinctions in wavelength resolved transmission imaging enables investigations of crystalline features from phase distributions and changes up to the reconstruction and observations on individual grains in polycrystalline materials. The additional exploitation of the magnetic moment of neutrons paves the way to also observe magnetic phenomena. A comprehensive overview of the potential and status in advanced neutron imaging and examples of pioneering applications shall be presented.

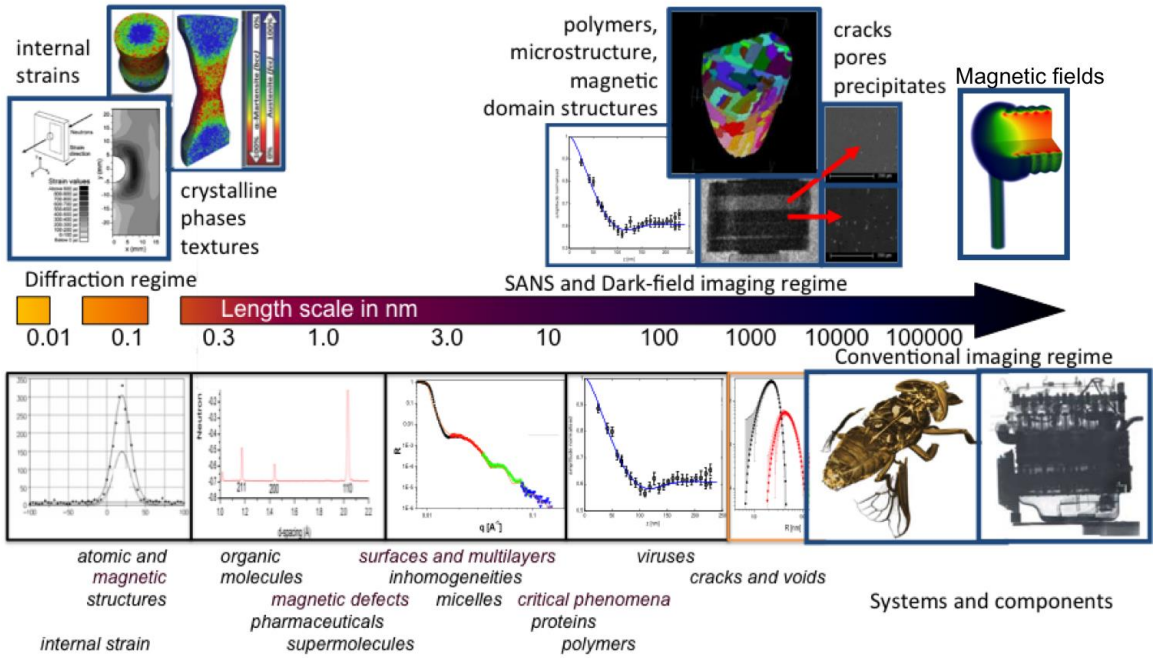

Fig. 1 The scope of advanced neutron imaging in the context of neutron scattering techniques

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[2] M. Strobl et al., J. Physics D 52, 12 (2019)
[3] R. Woracek et al., Nucl. Inst. Meth. A 878 (2018)
[4] M. Strobl et al., J. Imaging 3 (2017) 64