XRPD and TEM as tools to determine crystallite size of nanocrystalline iron

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Nanocrystalline iron and its compounds became of high interest lately due to their numerous applications e.g. as magnetic devices in medicine or EMI shielding and filtering [1-3].

A method commonly used to determine structural properties of these materials, such as crystallite size, is X-ray diffraction (XRD). However, analysis of the data with different approaches [4-7] might lead to ambiguous results. For this reason, the use of different analytical techniques is required to confirm the XRD analysis. Here, we have chosen electron microscopy (EM). It needs to be pointed out, that this method might be misleading as well. The EM images show particles that tend to be agglomerates of multiple crystallites when XRD focuses on separate crystallites with continuous lattice.

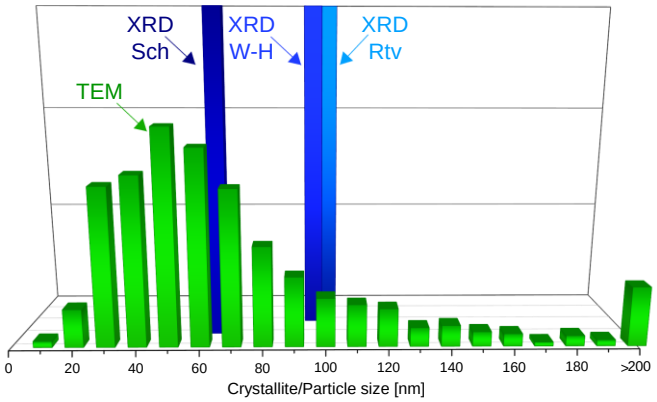

Fig. 1. Comparison of crystallite sizes determined with Scherrer method (Sch), Williamson-Hall method (W-H), Rietveld refinement (Rtv) and transmission electron microscopy (TEM)

In the presented study a nanocrystalline iron was examined with different approaches utilising X-ray diffraction and transmission electron microscopy. The experiments were carried out with the use of Philips X'pert PRO MPD X-ray diffractometer and Tecnai F30 TEM.

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