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Structural Fingerprinting of Nanocrystals in the Transmission Electron Microscope

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Two novel strategies for the structurally identification of nanocrystals [1] from either a high resolution (HR) transmission electron microscopy (TEM) image or a precession electron diffractogram (PED) [2] are described (and demonstrated on a mixture of nanocrystalline maghemite and magnetite [3]). The structural information that can be extracted from a HRTEM image is the projected reciprocal lattice geometry, the plane symmetry group, a few structure factor amplitudes and phases. Except for the structure factor phases, the same kind of information can be extracted from a PED, but the information that can be used for structural fingerprinting is in this case not limited to the resolution of the TEM. Searching for this kind of information in (open access) databases (e.g. [4]) and matching it with high figures of merit to that of candidate structures allows for highly discriminatory identifications of nanocrystals.

[1] P. Moeck, P. Fraundorf, Z. für Kristallogr. 222 (2007) 634-645; open-access issue at http://www.atypon-link.com/OLD/doi/pdf/10.1524/zkri.2007.222.11.634; expanded version at arXiv:0706.2021
[2] http://www.nanomegas.com
[3] P. Moeck, arXiv:0804.0063
[4] http://nanocrystallography.research.pdx.edu/CIF-searchable