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Mossbauer and magnetic investigations of High Entropy Oxides

Topic Area: T5: Physical, Chemical and Functional Properties

J. Cieslak[1,*], M. Reissner[2] J. Dąbrowa[3], M. Stygar[3] and M. Mozdzierz[3]

[*]Corresponding Author: cieslak@fis.agh.edu.pl

[1.] AGH University of Science and Technology, Faculty of Physics and Applied Computer Science, Cracow, Poland
[2.] Institute of Solid State Physics, TU Wien, Austria
[3.] AGH University of Science and Technology, Faculty of Materials Science and Ceramics, Cracow, Poland

Two High Entropy Oxides (HEOx), namely $(CrMnFeCoNi)_3O_4$ and $(CrMnFeCo)_3O_4$ were synthesized and characterized using diffraction techniques. They were found to be *Fd-3m* single phase spinels. Their magnetic properties were studied in detail using VSM techniques and Mossbauer spectroscopy. The former allowed determining the average magnetic moment and (partly) the magnetic ordering temperature T_{ord}. Using the later measuring technique, the determination of T_{ord} was clarified and the values of hyperfine parameters in a large temperature range were described. The presence of Vervey transition in these systems was excluded. Interestingly, unlike the spectra of magnetite, HEOx Mossbauer spectra do not show a clear distribution of Fe atoms on two sublattices, instead some asymmetry features associated with the presence of quadrupole splitting (not observed in Fe_3O_4) are visible. Low-temperature Mossbauer spectra were analyzed taking into account the coexistence of the hyperfine field distribution and the quadrupole splitting distribution caused by the multitude of elements on the sublattices. Based on Mossbauer measurements and electronic structure calculations (KKR-CPA method) and total energy analysis of the system, it was found that in both cases the samples have an inverse spinel structure.

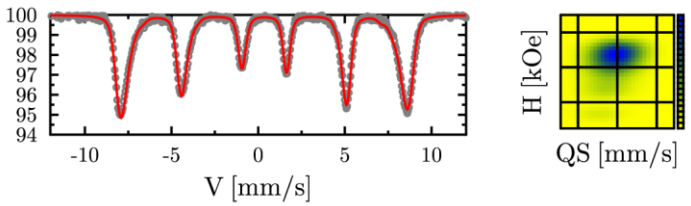

Figure 1: Mossbauer spectrum and corresponding two-dimensional hyperfine field – quadrupole splitting distribution of $(CrMnFeCo)_3O_4$ High Entropy Oxide measured at 80K.