Geophysical Research Abstracts
Vol. 17, EGU2015-10092, 2015
EGU General Assembly 2015

The influence of anthropogenic pure iron on magnetic properties of indoor dust.

Beata Górka-Kostrubiec and Maria Teisseyre - Jeleńska
Institute of Geophysics, Polish Academy of Sciences, ks. Janusza 64, 01-452 Warsaw, Poland. kostrub@igf.edu.pl

In our earlier work Górka–Kostrubiec et al., (2014) we presented the consistent study of magnetic properties of indoor dust involved about 200 apartments in various locations in Warsaw (Poland), which were affected by various sources of external pollution. Detailed measurements of magnetic properties of dust revealed linear relation between the magnetic susceptibility and the concentration of toxic metals and trace elements expressed by the Tomlinson Pollution Load Index (PLI). The data was divided into two sets which differ in the slope of each branch. Although them both showing linear relation of PLI(χ).

The aim of the present study is to find the differences in the magnetic mineralogy, structure and grain size between dust samples belonging to the 1^{st} and 2^{nd} sets revealing the relation of PLI *versus* χ.

For this purpose, the dust samples representing the maximum, middle and low values of PLI on both branches were selected. For these samples the temperature-dependent magnetic parameter M(T) and the hysteresis loops were examined. The curves of M (T) showed two magnetic phases - magnetite and pure Fe in variable proportions. For samples belonging to the first branch the contribution of pure Fe to magnetic fraction calculated from the decrease of magnetization on the M (T) curves was in the range from 29% to 38%. The higher contribution, more than 74% was observed for the second branch.

The heating up to 800^{o}C caused the chemical changes in the magnetic mineralogy, which are demonstrated as an increase in magnetization at room temperature after cooling. The samples from the 1^{st} branch showed higher changes than the samples for the 2^{nd} one. This result indicates that different types of chemical reactions occur during heating in both groups.

In order to observe changes in the structure of mineralogy and grain size the hysteresis loops for the samples before and after heating to 800˚C were determined. Very narrow loops (with low values of H_c and M_{rs}) were observed for the samples containing high contribution of pure iron. After heating, the loops were wide and their parameters are characteristic for SD+MD grains of the magnetite. The results show that the small amount of soft-magnetic pure iron significantly affects the values of hysteresis parameters , i.e. shifts the ratios B_{cr}/B_c towards larger value and M_{rs}/M_s towards smaller values on the Day-Dunlop's diagram.

The recognition of morphology and chemical composition of the magnetic fraction was confirmed by the scanning electron microscope observation and the energy dispersive X-ray spectrometer measurement. Microscopic observations of dust samples revealed the presence of the elongated particles composed of pure iron. We found that magnetic susceptibility correlates with the concentration of following anthropogenic elements: Co, Cr, Fe, Ni but only Fe concentration influences high values of susceptibility observed in 2nd set of samples.

Reference:

B. Górka–Kostrubiec, M. Jeleńska and E. Król. (2014) Magnetic signature of indoor air pollution: household dust study. Acta Geophysica vol. 62, 1478-1503, DOI: 10.2478/s11600-014-0238-1.