

Dust from tram tracks and streets in Krakow (Poland) as a source of magnetic components of the atmospheric aerosol

MAREK MICHALIK¹, JAN M. MICHALIK², MARTA GAJEWSKA², WANDA WILCZYNSKA-MICHALIK³, KINGA JAROSZ⁴, DANIEL GRZYBCZAK⁵ AND JULIA KRZYZOWSKA⁵

¹Jagiellonian University in Krakow

²AGH University of Science and Technology

³Polish Geophysical Society

⁴Jagiellonian University in Krakow, Institute of Geological Sciences

⁵Jagiellonian University

Presenting Author: marek.michalik@uj.edu.pl

The dust collected from tram tracks and streets in Krakow was studied as a source of magnetic particles in the atmosphere. Samples were analyzed using scanning and transmission electron microscopy with energy dispersive spectrometry, X-ray diffraction, chemical analysis of bulk samples and Mossbauer spectrometry (MS).

Magnetic fraction of samples from tram tracks is rich in Fe (from 3.9 to 20.4 wt%) and Cr, Ni, Cu (up to more than 2000 ppm, 890 ppm and 370 ppm respectively). Size of Fe-rich particles varies from 20-30 micrometers to below 10 nm. Nanoparticles occur mostly in clusters. Several types of particles can be identified based on their chemical composition (rich in Fe, Cr and Ni, rich in Fe and Mn, and scarce particles with high content of Ti). Granulated quartz grains are common, some of them containing finely dispersed matrix between fragments. Peculiar morphological type of particles related to the shearing processes was observed, often containing elongated Fe-rich forms embedded in Si, Fe and O rich fine-grained material with the orientation of some components parallel to the orientation of Fe-rich forms.

MS results show a presence of hematite, magnetite, goethite-hematite (nanoparticles, microparticles and bulk) and, most intriguingly, metallic iron usually not present even in samples from heavy polluted areas.

The content of Fe in dust from streets (whole samples) ranges from 0.9 to 1.6 wt%. Dust from streets is dominated by quartz and various silicates and aluminosilicates but also phosphates, sulphides, oxides. A presence of ferrihydrates, sulphates and green rusts related components is also suggested by MS. Fe-rich particles often contain Mn, Cr and Ni. Enrichment in Ti is less frequent. Zn occur as admixture in Fe-rich particles or as dominant components is S rich particles. Particles with high content of Pb contain also Ba. Particles rich in Sb and S or Ni, Co and As are scarce.

Dust from tram tracks and streets it is very diverse in terms of particles size, morphology and chemical composition and could be hazardous for human health. Dust contains a large number of