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Magnetic characterization of PM10 using non-linear Preisach maps. Toward domain state identification of magnetic anthropogenic particles

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According to World Health Organization, nowadays almost the entire global population (99%) breathes air that threatens its health (WHO, 2022), The greatest concern is related to air pollution by particles and nitrogen dioxide, people living in cities facing every day's unhealthy levels of these pollutants. Due to their multitude of sources, natural (mineral dust, sea salt, volcanoes, etc.) and anthropogenic (traffic, industry, constructions, agricultural activities, etc.), atmospheric particulate matter (PM) levels and physical properties vary greatly in time and space. Here we investigate the magnetic properties of PM10 (PM less than 10 μm) sampled in three different locations from Romania chosen so as to reflect as much as possible different origin of atmospheric particles. We use non-linear Preisach maps in tandem with Scanning Electron Microscopy (SEM) coupled with Energy-Dispersive X-ray spectroscopy (EDS), SEM/EDS, to specify more precisely domain states and characteristic magnetic signature of magnetic grains in PM10 fraction. PM10 aerosol samples were collected at three different sites in southern Romania: Bucharest site as urban, heavy impacted by traffic in the very center of the city, Magurele as suburban, under the influence of Bucharest and of the agricultural activities in the surrounding areas and Matasari, a rural site located in south-western Romania that was heavily impacted by the industrial activities at the open-pit coal mines located in the proximity. Our study highlighted three main types of magnetic mineral pollutants in the PM10 samples from Romanian industrial, urban traffic and suburban environments.

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