

Exploration of metallic iron in dust from ventilation system using Mössbauer spectrometry, synchrotron radiation and magnetic methods

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Abstract

In this work, the evidence of metallic iron in ventilation system dust has been performed. The presence of metallic iron can be regarded as an indicator of anthropogenic and technogenic "fresh activity" – contrary to the case of environmental samples from postindustrial regions [1,2]. Numerous experimental techniques have been applied for the characterization of the samples (raw ones and magnetic separates): transmission Mössbauer spectrometry, SEM-EDS, XRF-WDS, TEM, XRD, magnetometry and synchrotron XAS – NEXAFS. In the Mössbauer spectra, several phases – typical for environmental dust – were identified, like hematite, magnetite and aluminosilicates with Fe³⁺ and Fe²⁺ sites [1,2]. However, two other subspectra could be assigned to the metallic iron as well as to the metallic α -Fe and iron carbides from steel. This could be a natural consequence of the fact that the ventilation system operated in the vehicle diagnostic laboratory hall (in the Faculty of Transport, Electrical Engineering and Computer Science at Radom University, Poland). Unfortunately, clear and direct interpretation was not possible, because the corresponding subspectra were very smeared – possibly due to the small size of the strongly defected grains. Such explanation was confirmed by the results of thermomagnetic measurements – especially owing to hysteresis loops decomposition procedure. The synchrotron radiation absorption experiment (XAS–NEXAFS) confirmed undoubtedly the presence of metallic iron.

Keywords: dust, ventilation system, Mössbauer spectrometry, synchrotron radiation, magnetic methods

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