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Low- and high-temperature magnetic properties of iron-bearing particles of combustion origin

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Magnetic particulates in the urban atmosphere are often observed in the forms of spherules and aggregates derived from iron impurities in fossil fuels upon combustion. Recently, magnetic properties of various atmospheric samples gather a scientific interest as economic and rapid proxies in the pollution studies based on their strong linkage to heavy metals and/or volatile organic carbons. Here we present low- and high-temperature magnetic properties of iron-bearing spherules and aggregates separated from the dry-deposit of aerosols and vehicle exhaust emission, respectively. Spherical particles behave like magnetite with the domain state of pseudo-single-domain even for larger than 10 μm in diameter. This probably involves the growth of magnetite branching small particles with a dendritic texture. For the aggregates containing abundant sulfur, only a magnetite signal can be found in low-temperature but both pyrrhotite and magnetite signals occur in high-temperature. Such discrepancy indicates that aggregates of magnetite-like particles with non-monoclinic pyrrhotite due to the absence of low-temperature transition in remanence at around 30 – 35 K.