Spectrally and angle resolved light scattering properties of graphite and expanded graphite particles

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Carbonaceous particles (amorphous carbon, graphite, carbonates, nanodiamonds, etc.) of highly irregular shapes are a major constituent of the interstellar dust and planetary regolith layers. Depending on their origin, they can be compact or fluffy aggregates of sub-micrometer to micrometer sized grains with large values of the real and imaginary parts of the refractive index and can be sometimes embedded in an absorbing mantle or in the form of composite grains. The proper study and analysis of the light scattered by interstellar dust particles is very important as such results help in remote detection and retrieval of information about their physical properties. In this context laboratory research on the properties of terrestrial interstellar dust analogues are of great astronomical importance as their properties are found to be similar to the properties of planetary regoliths, cometary dust, etc. [1].

Graphite and expanded graphite particles, which can be considered as potential candidates of interstellar carbonaceous dust analogues, are chosen as samples for our investigation. Importantly, graphite can transform into expanded graphite at suitable environmental conditions (e.g., chemical, thermal, etc.) with abrupt changes in their optical, electrochemical and mechanical properties. The knowledge of the scattering properties of such particles is essential for deducing their physical and optical properties, which in turn may give clues for understanding earlier events like formation of comets, planets, etc.

In this contribution, we report measurements of the spectrally and angle resolved light scattering properties of graphite and expanded graphite particles in the 396–625 nm optical spectrum by using a laboratory based goniometric setup. The instrument is capable of measuring the scattered light signals at scattering angles from 25° to 155° in steps of 1°. The accuracy and the reliability of the setup were verified by conducting light scattering measurements on spherical water droplets and comparing the results with theoretical Mie calculations. The experimental errors were reduced by taking the average of a large number of scattering measurements on the same set of samples. Comparisons of the experimental results with theoretical calculations will also be presented.

References

[1] Volten, H., Munoz, O., Rol, E., Haan, J. D., *et al.*, 2001: Scattering matrices of mineral aerosol particles at 441.6 nm and 632.8 nm. *J. Geophys. Res.* **106**, 17375–17401.

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