HYPERSPECTRAL INVESTIGATION OF THE ATAXITES SCHLIEREN BANDS

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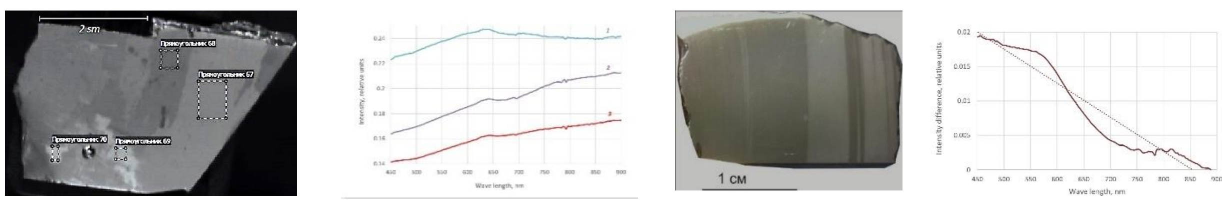
Introduction: The structure of the ataxites (plessite) is usually matt when observed with a naked eye or with an optical microscope. But it also contains a volumetric macro-effect of a periodic ordered structure that glitter under different angles of observation. It is considered to be formed during phase transformations in the parent single crystal of Fe-Ni [1,2,3] and called Schlieren Bands [1]. The structure of the bands being chemically identical differs only in crystallographic orientation of the bcc-phase subgrains [1,3]. In this paper, we observe the front-reflection spectrum of the Schlieren bands in Hoba (16,56 wt.% Ni, 0,07 wt.% P) and Chinga (16,58 wt.% Ni, 0,05 wt.% P) using the Specim IQ hyperspectral camera with a high-resolution matrix.

Methods: The study was carried out in a blackened chamber of the original design. A hyperspectral camera and two halogen and two IR lamps on both sides of it were mounted on the same holder at a distance of 80 cm from the sample. The camera has a resolution of 512x512 and a 10-bit linear CMOS sensor, a slit size of 42 microns and manual focusing. Using the Albedo program up to 20 rectangular sections of 100 - 3000 points were selected for analysis in the obtained digital images of each sample (fig.1a). Then the graphs were plotted in the operating wavelength range from 397 to 1100 nm (fig.1b).



a b c d

Fig.1 – Experimental data: a - Hoba section image with the areas of analysis, **b** – corresponding graph of the reflected light intensity: 1 – "highlights" area, 2 – "Light" band, 3 – "dark" band, **c**- Chinga sample image, **d** - Chinga plot of subtraction "Light"-"Dark" with a trend line.

Experiment and results: Hoba meteorite was studied in "Light", "Dark" areas and "highlights" near the inclusions formed of coarse plessite (Fig. 1a). There is a single peak at a wavelength of 643 nm. "Highlights" have an additional peak at 455 nm. In the near IR region only the graph for the "dark" area continues to grow, the rest go to the "plateau". For Chinga the graph of the intensity difference (Fig.1c) has a significant slope from 560 to 770 nm indicating the increase of the "dark" band intensity. If we present the surface structure as a diffraction grating, then the highest intensity will indicate the size range of the subgrains of plessite that make up the lattice (formula 1).

$$d \cdot \sin\theta = m \cdot \lambda, \text{ where } \theta = 90^{\circ}, \quad (1)$$

m- the maximum order.

For the "Light" Band, we assume the prevailing spectral range of 430-560 nm, for the "Dark" 770-900 nm. According to the formula 1, the average size of the most subgrains in plessite is a multiple of the peak wavelength. Intermediate subgrain sizes are more characteristic for the "Dark" Band. These data are consistent with our previous studies of Chinga in the visible spectral range [4].

Conclusion: The intensity difference between the spectrum graphs for dark and light Schlieren bands is recorded in each meteorite studied. The obtained spectra have a stable slope and no more than two obvious peaks, which determines the most characteristic periodic structure for a given area. For Chinga and Hoba the size of bcc-subgrains in plessite is 410-510 nm for "light" Schlieren band, and 510-660 nm for the "dark" one. The greatest intensity is characteristic of the area of "highlights"- coarse plessite with a structure multiple of 455nm size. Thus, the application of optical methods made it possible to confirm the difference between the micro-structures of the Schlieren Bands.

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