DIGITAL PROCESSING OF LIGHT SCATTERING PATTERN WHEN MEASURING THE SIZE OF MICRO-PARTICLES

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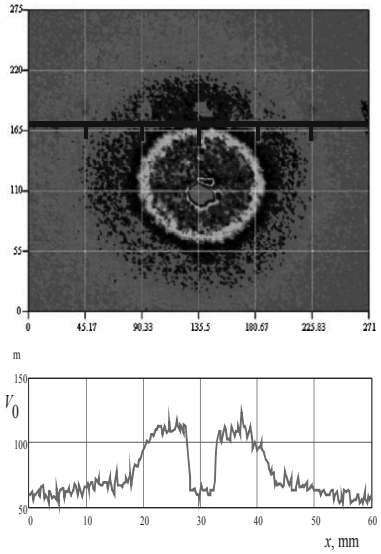
The paper deals with the method of measuring the size of micro-particles. The method is based on the computer processing of digital image of scattering pattern. Optical methods are often used for measuring the size of micro-particles and based on the fact, that the shape of scattering pattern by particles depends on the relation d/λ (d is particle size, λ is radiation wave-length).

Pollen of a plant was chosen as an object of the experiment. As it turned out its particles have the shape near to spherical.

The particles are placed between two glass plates. The laser radiation (λ = 0.65 μm) goes through the plates and falls on white screen, which is placed at the distance of L = 307 mm from plates with particles. The scattering pattern looks like a system of concentric light and dark rings, because all the particles are of approximately identical size and shape. The angular dimensions of rings can be found from the analysis of diffraction problem about plane electromagnetic wave on a sphere:

$$F(\varphi) = \rho^4 \left(\frac{J_1(\rho\varphi)}{\rho\varphi} \right)^2,$$



The scattering pattern and intensity distribution along its axis

where $\rho = \pi d/\lambda$, φ is scattering angle, $J_1(z)$ is Bessel's function. Sizes of diffractions rings (positions of minima and maxima of intensity) are determined by the values of zeros of Bessel's function

In our experiment we have found the parameter of diffraction problem: ρ = 68.8. Diameter of particles can be calculated by the formula $d = \frac{\rho \cdot \lambda}{\pi}$. At the wave-length of laser irradiation λ = 0.65 μm the diameter of pollen particles equals to d = 14.2 μm. The obtained number coincides well with the value of particle size obtained by means of a microscope.