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Exponential Business and Technologies Company

Concentration and Size of Particles in a Diamond Polishing Slurry

The manufacture of polishing slurry requires reliable information on the particles' size, size distribution and concentration for desired polishing results. On the industrial scale, such information has been traditionally obtained via sieving for particles larger than 70 μm and sedimentation for particles smaller than 60 μm . However, when higher accuracy is needed, especially when particle concentration in slurry becomes necessary, more advanced techniques such as the particle characterization technique based on the so-called Coulter Principle is required.

The Coulter Principle is a method that uses an electric field to count and size particles dispersed in a conducting liquid. When a particle passes through a small orifice, the electrical conductance across the aperture changes relative to the amount of volume displaced by the particle. This results in measurable electrical pulses which can be used to determine the size of the particles in a suspension. Unlike laser diffraction methods, the Coulter Principle yields exact particle counts which can be used to determine the sizes and their concentrations of the particles in a slurry.

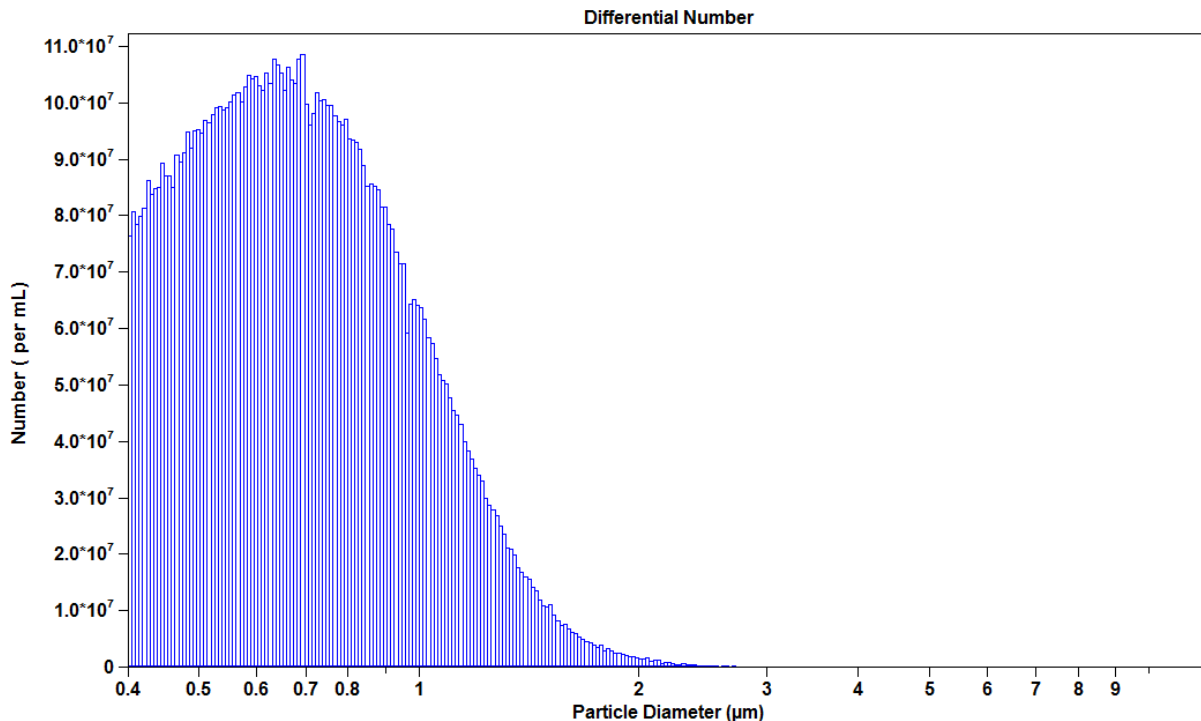


Figure 1. Particle size measurement for a 1 μm polycrystalline diamond polishing slurry.



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A high quality test instrument based on the Coulter Principle, such as the Multisizer 4 Coulter Counter equipped in Ebatco's Nano Analytical Testing Laboratory (NAT Lab), is capable of characterizing a wide range of particle sizes and concentrations. Since particle size measurements are limited based on the size of the measurement orifice, the Multisizer 4 comes equipped with a number of different aperture tubes which allow the instrument to measure particle sizes ranging from 200 nm to 1.6 mm. This broad detection range allows such an instrument to be used for a wide variety of different applications including hematology, paints, ceramics, pharmaceuticals, abrasives, food and beverages, etc.

Table 1 Particle Size and Concentration Results
for 1 μm Polycrystalline Diamond Polishing Slurry

Analysis Range	0.4 μm – 12 μm
Number (per mL)	8.804x10 ⁹
Mean (μm)	0.736
Median (μm)	0.675
S.D. (μm)	0.27

The data presented in Table 1 is for the 1 μm polycrystalline diamond polishing slurry tested using the NAT Lab's Multisizer 4 Coulter Counter. Figure 1 shows the actual particle number per milliliter at different sizes. By using a known sampling volume, the concentrations of suspended particles at different sizes were successfully measured.