



**Synthetic Diamonds – Natural Diamonds – CBN Cubic Boron Nitride –
Synthetic Diamond Powder for Polishing – Technical Consulting**

QUALITY CONTROL



QC Procedures

Quality Control and Testing Procedures

LANDS Superabrasives performs various standard tests in order to assure and maintain a consistent standard in its product line. In order to guarantee optimum Quality Control in producing consistent materials throughout the line, LANDS Superabrasives has developed a standard testing procedure that involves continuous monitoring of the vital variables. This testing procedure is one of the cornerstones of our Quality Control Program.

In the following paragraphs LANDS Superabrasives presents some of the standard tests used in the Quality Control Maintenance of the product line.

Description of Tests and Testing Procedures

Friability Test. Toughness Index:

Test Objective: The main purpose of this test is to determine the relative strength of the diamond particles. The core of this test is to determine the particle size after the material is subjected to controlled crushing.

Test Procedure: First the diamond is sieved and measured. The sample is then subjected to controlled crushing in a mill using hardened steel balls. The vibration, movement and amplitude of this process is fully controlled. After a defined time period, the diamond is collected and measured again. There is a direct correlation between the spread in residue sizes after crushing and crystal strength. In general, the coarser and larger the residue, the stronger the original crystal; the finer and smaller the residue, the weaker the original crystal

Result: A Toughness Index is generated by using a formula which relates the various factors of time, crushing procedure and final particle size.

Friability Test after Thermal Impact. Thermal Toughness Index:

Test Objective: To determine the thermal stability of diamond products.

Test Procedure: This test is the same as described above, however the diamond is first heated to 1125°C. in a controlled non-oxygen atmosphere.

Heating may cause the crystal to break up or to damage the surface, edges and the faces. Strong crystals will yield lower percentages of fine sizes while weaker crystals yield relatively higher percentages of fine sizes.

Result: A Thermal Toughness Index is generated by using a formula which relates the various factors of time, crushing procedures and final particle size. The higher the value of the TTI, the stronger the crystal.

Bulk Density:

Test Objective: To determine the density of the material

Test Procedure: The bulk density is determined by the weighing the amount of material required to fill a predetermined volume. (Similar to 1 kg of water fills exactly 1 Liter.)

Result: Bulk density provides a relationship between the average shape, smoothness of the crystals and specific weights.





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Size Analysis. Sieving Index:

Test Objective: To determine the size of diamond particles.

Test Procedure: All Mesh powders are sieved according to the latest ASTM / FEPA standard sieving procedures using electro-formed sieves (ANSI B74.16, FEPA and ISO 6106)

Both "Mesh" and "Micron" sizes are obtained by applying consistent and stringent procedures to sieving and sieving techniques.

Result: Consistently graded products, with uniform distribution.

Color Index:

Test Objective: To determine the color of diamond particles to insure color consistency of diamond specimens.

Test Procedure: a light diffractometer determines the exact color of all diamond specimens.

Result: By setting color range standards, LANDS guarantees color consistency for each and every product. If the specimens are not within the range of tolerances, batches are rejected.

Morphological Spread:

Test Objective: To determine the shape of diamond crystals.

Test Procedure: Diamond crystals are put on vibrating tables, which result in the separation of the material into various batches of crystals having similar shape. Each shape is assigned a relative index value that indicates the overall particle shape of the sample.

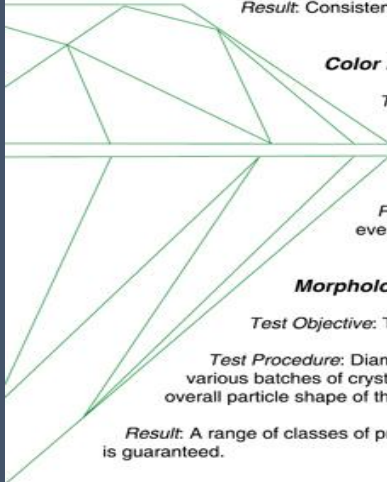
Result: A range of classes of products, wherein each class of crystals are graded so that a uniform and consistent product is guaranteed.

Visual Aspects:

Test Objective: To determine various visual appearances.

Test Procedure: The diamond is checked under a stereo microscope with different illuminations (light intensities). Shape, structure, color and degree of inclusions are examined.

LANDS issues histograms upon request, showing the distribution of particles in the powders, measuring median and Cumulative Distributions. In addition to the above tests, LANDS Superabrasives administers a variety of other proprietary tests on the aspects of diamond properties such as Impact Resistance, Fatigue Resistance and Crystal purity.





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Production Flow

Quality Control - Production Process

- * Incoming source material is logged in per batch/unit from origin, and provided with traceable and unique lot-number.
- * Depending on the ultimate purpose and destination of the diamond, lots are directed through the various channels of the operation; each lot can be definitively marked and followed through the complete operation.
- * Various methods and technologies are used to sieve, separate, sort, table and (for certain applications) milled, rolled, and crushed depending on which grade of LANDS Superabrasives products is required.
- * The various LANDS Superabrasives Product types may be further treated, and/or coated with nickel, copper or other coatings depending on the ultimate requirement of the users.
- * Micron powder production line: various methods and technologies are used to obtain rigidly size-controlled microns. Source material is treated according to above steps and procedures. Appropriate techniques for cleaning and chemical treatment are used to obtain standard material ready for further processing. LANDS Superabrasives uses different micronizing technologies from sedimentation to centrifuge-technology amongst others. Strict procedures are followed to avoid contamination of the microns in any step of the process. After the micronizing and drying processes are completed, the appropriate post micronizing-treatment, such as treatment for use in electroplating, coating with Ni. etc., are applied.
- * Various techniques are used to check diamond particle size. Laser diffraction, Electrical Sensing Zone, and Image Analysis are examples of some additional tests.
- * Methods and technologies include sieving procedures using electroformed sieves according to ANSI B74.16, FEPA and ISO 6106. Bulk-density standards are according to ANSI B74.4-77. Magnetic contents of particles determined by magnetic analyzer. ANSI B74.19. Micron Size Std. IDA, FEPA 1997 and ANSI B74.20 are applied to determine compliance in grading of microns.

