EFFECTIVE CLEANING METHODS AND BEST PRACTICES OF SYNTHETIC INDUSTRIAL DIAMOND

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Synthetic diamond is used as a super abrasive in many industries, from electronics to medical applications. These industries as well as others require cleanliness of the base product as paramount to a quality end product. One should understand some basic facts about synthetic diamond in order to grasp a better understanding of its abrasive application within the industrial sector. The following is a rudimentary narrative of the synthetic diamond synthesis process.

SYNTHETIC DIAMOND

In synthetic and natural diamond, impurities exist and are known as inclusions. They appear as dark spots, dispersed clouds or opaque sections and are composed of many basic elements as hydrogen, nitrogen, oxygen boron, magnesium, aluminum, silica, calcium and other trace elements. Impurities that occur in synthetic diamonds are elements resulting from other metal catalysts used in production. Main catalysts are a combination of nickel, iron and cobalt. Other impurities in synthetic diamonds are mainly from the high temperature, high-pressure (1,800 deg. C at 25 – 30GPa) reaction chamber and post processing.

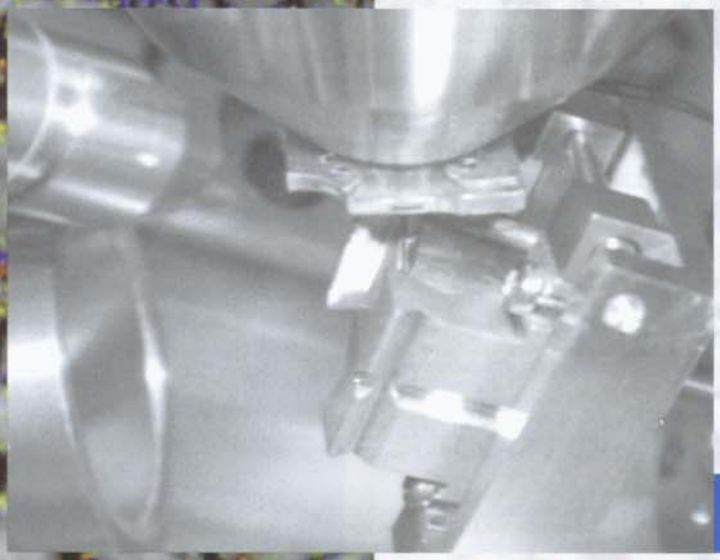
Elements that are commonly monitored in synthetic diamond are aluminum, calcium, cadmium, cobalt, chrome, copper, iron, potassium, magnesium, manganese, sodium, nickel, silica, tantalum, vanadium, zirconium, zinc and boron. Each of these elements play a role in the end use of the synthetic diamond and the quantity of impurities allowed—depending on the intended end use.

It should be noted, however, that the intended use is as critical as the materials that are being used in part of the overall manufacturing process. In many cases, the base material—synthetic diamond, can cause down stream processing problems for manufacturers. In simplistic terms, it is never good to eat from a dirty plate.

Let's look at some of the reasons why the purity of a diamond surface is important.

CLEANED MESH OR MICRON DIAMOND

The need for surface cleaned mesh or micron diamond is paramount to post-processing and for final products. The reasons for this can briefly be described as follows. Surfaces that contain certain levels of iron or other magnetic metal impurities can create problems in a Nickel or Copper electroplating operation. Synthetic diamond containing too much iron will make it magnetic, which in turn, will result in the diamond attaching to itself instead of the plating, chemical. The final results are the formation of agglomerates that decrease yield or cause an oversize condition on the final product. Both are undesirable. Diamond that contains too much calcium impurity will leave calcium deposits in a lapping operation that will be difficult to remove. The deposit will require an additional cleaning removal step—resulting in unnecessarily cost increases. Diamond that contains too much manganese will cause computer read-rite heads to depolarize pole tips in a lapping operation rendering them useless.



Other synthetic diamond particles that are based on surface attraction forces from upstream processing can easily adhere to one another. This adherence can form clusters that can be connected by a network of interconnected pores or surface ions. These clusters are known as agglomerates. Agglomerates will create processing problems if they are used in suspensions because they distort the distribution of particles and create unwanted artifacts as scratches on polished surfaces or voids in solid pieces. A medical prosthesis as a hip ball needs to be a solid piece. Tiny voids created by these agglomerates can cause stress