

## Synthetic Type 2a Anvils with Ultra-Low Fluorescence Available from easyLab and diamondANVILS.com

Natural diamond crystals have been used for DAC anvils for many years now. Although widely successful, natural anvils suffer from a limited lifetime, stability and attainable pressures because of the crystal defects inherent to them as well as quality variations. Furthermore, natural diamond crystals emit luminescence, which may make it difficult to measure the optical signal from a sample placed inside the DAC.

High Pressure High Temperature (HPHT) synthesis of diamond became a commercial reality during the 1950s and remains the major manufacturing method for synthetic diamond products whose main application is in tooling solutions for industry. In essence, HPHT emulates the way in which natural diamonds are created deep in the earth where the enormous pressure means that carbon crystals with the denser structure of diamond are thermodynamically more stable than those of other carbon allotropes such as graphite.

Now, synthetic high-purity diamond crystals (type 2a) are available for anvil applications. These diamonds have very low nitrogen content of less than 1 ppm, a purity which is much higher than natural type 2a diamonds that are already extremely rare in nature. As such, these synthetic type 2a diamond crystals have virtually no absorption bands due to impurities over a wide range of wavelengths from far ultra-violet (225 nm) to far infrared (>20  $\mu\text{m}$ ) regions except the multi-phonon absorption, and have fewer crystal defects and less internal strain than natural diamonds or common synthetic type 1b diamonds.

In addition, the laser-excited luminescence level of the synthetic type 2a diamond is very low indeed. In fact, the intensity of the two-phonon Raman transition at  $2664\text{ cm}^{-1}$  of these synthetic diamonds is 5 to 15 times the intensity of the background fluorescence of a natural diamond. The figures below show the Raman spectra (532 nm laser excitation) and the FTIR spectrum of a typical synthetic type 2a diamond anvil. It is not difficult to see that one expects synthetic type 2a diamond crystals to be extremely useful as diamond anvils.

Please note that currently the height before polishing the culet for synthetic type 2a diamonds is restricted to 1.95 mm and diameters range from 2.50 mm up to 4.00 mm.

