

Art or Science: Machines for Processing Diamond And Other Ultra-Hard Materials

P J Heath

Peter Heath & Associates

420 North Bridge Rd

#04-37 North Bridge Centre

Singapore 188727

Email: pheath@singnet.com.sg

ABSTRACT

Diamond is the hardest material known. To cut, shape or braze this ultra-hard, extremely inert material can present considerable problems. This paper reviews some of the machines available for processing both single crystal diamond, polycrystalline diamond (PCD) and CVD diamond into useful tools and products. The methods and machines used to mirror polish large 100mm mother discs of PCD and CVD, laser cut these discs into individual pieces, then braze and grind these are also mentioned. With the right machines, the most perfect radii on the edge of natural and synthetic diamond cutting tools can be produced. Such tools are needed so that the most perfect of machined surfaces can be generated on lenses and mirrors, for example. But because diamond has both “hard” and “soft” crystallographic directions, special, ultra-precision, planetary grinding and lapping machines, which allow the soft directions of diamond crystals to be found and followed, must be used. The production of cutting tools with low waviness edges for high technology applications requires a combination of the right machines, an understanding of the science of diamond crystals and the art and patience of a skilled craftsman.