New Anvil and Gasket Designs

Reinhard Boehler

Max-Planck Institut für Chemie, Mainz, Germany

Mechanical stability and aperture in diamond cells can be significantly improved using conical supports for cone-shaped anvils. Because these anvils are machine-ground and smaller in diameter, they cost less than conventional anvils. The conical design allows for steel supports, which are significantly easier and cheaper to manufacture than tungsten carbide supports. Conical support also prevents seat damage upon diamond failure. An additional new feature of the anvils is the roughened outer portion of the culet, which increases friction between the anvils and the gasket. This increases the height to diameter ratio of the pressure cell and prevents bonding between gasket and diamond, which causes ring cracks during pressure release. The anvils have been extensively tested for culets ranging from 0.1 to 1 mm diameter up to megabar pressures. A new gasket design is also introduced. The stability of the gasket was significantly improved by filling laser-cut grooves with diamond powder. The procedure is straightforward and further increases the height to diameter ratios compared to pure metal gaskets. Example: For a 0.5 mm culet the the gasket height is typically 40 microns at 50 Gpa.