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Static Pressure Above 300 GPa Using Chemical Vapor Deposited Two-stage Diamond Micro-anvils[1] JEFFREY MONTGOMERY, GOPI SAMUDRALA, GEORGIY TSOI, SPENCER SMITH, YOGESH VOHRA, University of Alabama at Birmingham — Two-stage diamond micro-anvils were grown via chemical vapor deposition (CVD) on beveled diamond anvils with 30 micron central flats. These anvils were used to compress a pre-indented rhenium foil to pressures in excess of 300 Gigapascals (GPa) at relatively small applied loads. Powder diffraction patterns were collected across the high-pressure region using an x-ray beam collimated to 1x2 microns in a grid with a spacing of 1 micron. While multi-megabar pressures were seen across the entire second stage, the highest pressure regions were confined to areas of a few microns in diameter. These were observed at points near the edge of the second stage with nearby pressure gradients as high as 100 GPa/micron. The transmitted x-rays show that the second stage plastically deformed while maintaining multi-megabar pressures. This may have created a second-stage gasket consisting of CVD diamond and rhenium that supported the pressure gradient without substantial external confining pressure. Further improvements in two-stage diamond micro-anvils would require controlling the geometry and microcrystalline/nanocrystalline diamond content during CVD growth process.

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