TROUBLESOME BERYLLIUM POWDER LINES REMOVED FROM YOUR DIFFRACTION IMAGES, WHILE MAINTAINING THE PRESSURE RANGE AND OPENING ANGLE OF THE ORIGINAL DESIGN.

The implementation of carbide seats and Boehler-Almax design diamond anvils into a Merrill Bassett diamond anvil cell (DAC) is a great success. This design has removed the need for beryllium backing seats while increasing the pressure range and opening angle. This Boehler-Almax design is suitable for single crystal X-ray diffraction.

With the development of techniques which utilise CCD detectors to collect high-pressure single-crystal data, beryllium backing seats can still prove troublesome, as powder lines from the beryllium contaminate the diffraction pattern. This effect is amplified when using the high-flux, low divergence of synchrotron X-ray sources where the beryllium lines become more intense and ‘spottier’ in appearance (see pictures (d)-(e)). Steel or WC backing seats provide an alternative, however these materials are opaque to X-rays, and therefore central, large conical openings are required to maintain the opening angle of the pressure cell, as compared to the smaller optical hole in the beryllium seats (see figure (a)-(b)). Large conical windows mean that large anvils have to be employed (typically measuring 3-4 mm in diameter and 0.25 to 0.40 carat in weight). Not only are these expensive, but large diamonds are impractical for single-crystal diffraction experiments due to absorption from the diamond anvils. More importantly, the decreased support offered by these anvils can lead to anvil failure at elevated pressures, and can often cause costly damage to the diamond anvil and the backing seat. Recently, single crystal diamond supports have been employed in various forms allowing for smaller anvils. However, the overall increased thickness of the diamond window plus anvil presents a problem in some applications such as X-ray diffraction, where absorption in the diamond plays a role. Additionally, catastrophic anvil failure may cause costly damage to the diamond support plate.

Our new design of anvil and WC seat provides conical support to the anvils and increases the pressure range and sample volume, while the size of the conical anvils used are much smaller than those used with conventional WC backing seats.

CDI images of
(d) a Be-backing seat cell collected using a Mo X-ray source for 60 seconds.
(e) a Be-backing seat cell collected with synchrotron radiation ($\lambda = 0.6755$ Å) for 1 second.
(f) W-carbide seat cell collected using synchrotron radiation ($\lambda = 0.4767$ Å) for 1 second.
Note in (e) the much more textured Be-powder lines than in (f).