tive to the other, and under pressure some diamond damage is possible. This problem may be helped by the two pin system described in this paper. As may be observed from Fig. 3, both pistons will move together in the two pin system, and the diamonds will more easily maintain their alignment in respect to each other. Additionally, the two pin system is very helpful in mounting and aligning a new diamond anvil in respect to a second anvil.

The technique has been used in obtaining far ir spectra of pure liquids and of solutions under pressure.

The Application of the Quartz Crystal Microbalance for Monitoring Rates of Deposition of High Temperature Species in Matrix Isolation Infrared and Raman Spectroscopy

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The low temperature matrix isolation technique for producing and examining reactive or otherwise unstable species has been developed to a high degree of sophistication in the past 20 years. Often, the desired molecular fragment is generated by cocondensing a gaseous mixture, for example, CO in Ar, with a molecule or atom generated at high temperature by evaporation from a hot filament or by effusion from a Knudsen cell, for example, Pd or Pt atoms. Using this method the previously unknown carbonyls of Pd and Pt were gen-
erated and identified by matrix isolation infrared spectroscopy.\(^1\)

While in principle one can determine the rate of effusion from a pinhole of known dimensions given the vapour pressure of the solid at the working temperature, often such data are not available or, as in the case of evaporation from a hot filament, difficult to apply because of the geometric complexity.

Accordingly, a direct method for measuring the weight of material introduced into the matrix is usually required.

An ideal method for performing these measurements *in situ* is the quartz crystal microbalance.\(^2\) This technique makes use of the fact that the resonance frequency of an AT-cut quartz crystal operating in a thickness shear mode diminishes in a predictable way when mass is caused to adhere to one or both of its faces. The mass frequency relation is given by\(^2\)

\[
\delta f / f = -k \delta m / A
\]

where \(\delta f\) is the magnitude of the decrease in frequency, \(f\) the resonance frequency (fundamental or overtone), \(\delta m\) the mass of deposit, \(A\) the area of one face (assuming deposition on one face only), and \(k\) a constant which depends on the thickness of the crystal and the density of quartz. For a 5 MHz fundamental AT-cut crystal \(k\) is approximately 12 cm\(^2\)/g. Thus, assuming a crystal area of 1.3 cm\(^2\) (as in our case), Eq. (1) predicts a sensitivity of \(2 \times 10^{-8}\) g/Hz for operation at the fundamental. In practice a frequency stability of better than 1 Hz over a period of several hours is routinely attained.

Using a system similar to that described by one of us,\(^3\) we have successfully monitored the deposition rate of

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