Table 1 -- Transformation Pressure of BaF_2 from Fluorite to Orthorhombic Structure at Ambient Temperature (β to α phase)

Investigators		Transformation Pressure (kbars)
Minomura and Drickamer	(1961)	30.8
Chen and Smith	(1966)	36.0
Seifert	(1968)	25.0
Dandekar and Jamieson	(1969)	<20.0
Samara	(1970)	26.8
Kessler and Nicol	(1972)	23.0

If temperature of the press containing α-BaF_2 is quickly reduced from T to room temperature, and pressure is subsequently released, α-BaF_2 is found in the sample if $T < 470°C$ but not for greater T.[5,9] This temperature dependence of the effects of quenching is inexplicable on the basis of information given above.

It is very difficult to provide a clear explanation for disagreements among the investigators with regard to the pressure of transition at room temperature and its variation with temperature, and the variation in quenchability of α-BaF_2. However, one can easily think of a few of the variables which may have brought about those disagreements. For example the type of high pressure apparatus used in an investigation, the magnitude of hysteresis, impurities in the BaF_2 used could easily differ from one experiment to another and the experimental procedure to establish transition pressure, i.e. whether the pressure was observed by in situ examination of the sample or in a quenched sample. Inability to quench the orthorhombic phase at any pressure beyond 470°C tends to indicate that there may be a third phase of BaF_2 present at high temperature but below the melting temperature of BaF_2. That such a phase may exist even at one atmosphere is suggested by an observed transformation in the isostructural compound CaF_2 between 1047°C and 1100°C by Naylor.[12] The structure of this high temperature phase of CaF_2 remains undetermined.[13]

Finally the equation of state of the orthorhombic phase of barium fluoride is as yet undetermined.

III. SHOCK COMPRESSION EXPERIMENTS

Shock compression experiments were performed with the Washington State University gas gun. A detailed description of the gun and its operating characteristics are documented in ref. 14. Briefly, the gun is 44' long and four inches in diameter. It can propel a four inch diameter, 1 kg projectile with any velocity in

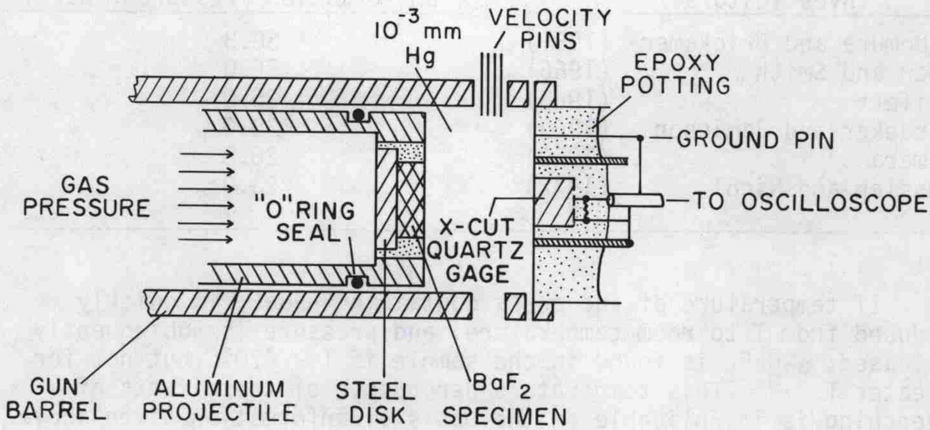

Fig. 1 -- An experimental assembly for measuring impact stress-time profiles. For measuring transmitted stress-time profiles a specimen is bonded to a quartz gage and mounted in the target. In recent experiments on BaF_2, the back-up steel disk was found not to be necessary for the impact stress-time profile measurements.

the range of 0.1 mm/μsec to approximately 1.4 mm/μsec. Angular misalignment between the impacting surfaces of the projectile and target is of the order of 5×10^{-4} radians or less. The entire impact chamber is evacuated to 10^{-3} torr to prevent an air cushion forming between the two impacting surfaces. The electronic recording instruments consist of Tektronix 454, 585 and 519 oscilloscopes. Parameters measured in the experiments are projectile velocity, misalignment of the projectile and target, and stress history either at the impact interface or at the specimen surface opposite the impact surface. A schematic of a finished experimental assembly for measuring stress history at the impact face is shown in Fig. 1. The stress gages used were x-cut quartz disks with 1/2" diameter and 3.2 mm thickness. These gages were used in the shorted configuration.

Shock compression experiments were performed on single crystals of BaF_2 oriented along <111> and <100> directions.[15] These specimens were in the shape of circular disks of diameter 22-25 mm and thickness ranging between 1.1 and 4 mm. Basically three types of experiments were performed. Experiments of the first type yielded stress history in the quartz gage after the shock wave was