

C. Magnesium Oxide (MgO)

Magnesium oxide, being a possible constituent of the earth's interior and of value as a high temperature refractory oxide, is of sufficient importance to warrant investigation of its material properties under impact loading. Knowledge of its wave propagation characteristics would be of considerable value to its respective applications. In the single crystal state, it is a brittle transparent solid with a simple sodium chloride structure, similar to LiF. It is hopeful that this simple structure might reduce the complexity of physical models and allow a basic understanding of the processes involved.

Sufficient investigation of the static properties of MgO have been performed to provide the complement necessary for a dynamic investigation. Its hydrostatic equation of state has been extended by Perez-Albuerne et al.²¹ to several hundred kilobars. Plastic yielding and fracture have been examined by Argon et al.²² Dislocation characteristics have been explored and reported.

Of considerable interest is whether brittle materials such as MgO exhibit conventional elastic-plastic behavior typical of more ductile materials. Some dynamic work²³ on MgO indicates that Hugoniot states above the elastic limit fall on or near the hydrostat. However, similar work²⁴ on aluminum oxide appears to show significant offset from the hydrostat implying a residual material rigidity. This difference for apparently similar materials raises doubts as to the applicability of either the fluid model or the elastic-plastic model in describing the physical processes observed. MgO is a reasonable candidate for further exploration of this question. It has a high elastic limit which will make it experimentally favorable. Its stress range of concern allows use of the manganin gauge as a transducer technique.

D. Tungsten (W)

A research program has been undertaken to study elastic precursor attenuation in single-crystal tungsten during shock compression. Tungsten has a body-centered-cubic crystal structure and is