temperature behind the shock front that is of interest. However, the surface temperature is very useful in validating models that estimate the internal temperature. To obtain the free-surface temperature accurately it is necessary to eliminate ejecta from the field of view. One way to reduce the ejecta to manageable levels is by polishing the sample surface to a metallographic finish. However, plutonium is very difficult to polish and it oxidizes quickly, further compromising the surface finish. Another technique involves using a transparent window, or anvil, fastened to the plutonium surface to tamp the ejecta and maintain the release pressure at a higher value, closer to the shock pressure than for free-surface release. The interface temperature is thus closer to the internal temperature and the model validation should be more accurate. Lithium fluoride (LiF) is currently the best material for use as an anvil and as a window to transmit the radiation from the interface. Its heating under shock is low and its emissivity is small. It is important that there be no air or other shock-light-emitting material in the plutonium-LiF interface, although this is difficult to achieve because of the difficulty of polishing plutonium.

We fielded six-channel infrared pyrometers on both polished samples and samples with windows attached to determine which provides better results and to obtain data for release both into vacuum and LiF. We also fielded a comparison measurement of a polished surface and one with a coarser finish to determine whether the ejecta problem was severe enough to require polishing Cimarron samples. With the information from the Stagecoach pyrometers we were able to design the Cimarron temperature samples for optimum chances of success. Pyrometric measurements were also fielded by personnel from Sandia. Data quality and results were similar to ours.

Cimarron

As the nuclear weapons stockpile ages, it will be necessary to make occasional small changes in the materials used and the processes by which the manufacturing is done. Materials in nuclear weapons, including plutonium, HE, and plastics, are subject to change from effects such as oxidation and radioactivity. As it becomes necessary to remanufacture weapons or change out parts, we must be sure that the effects of any changes are minimized and that the changes are understood as much as possible. Furthermore, we need to make baseline measurements of current unaged weapons so that we will know when they have changed.

Cimarron was designed to study the ejecta emitted from a shocked plutonium surface. Ejecta production is sensitive to the surface roughness and oxidation, the material grain structure, and the shock profile. Cimarron diagnostics fielded by the Physics Division included holography to measure the distribution in ejecta size, x-ray shadowgraphy to measure ejected mass density, visible-light shadowgraphy to observe the ejecta cloud, fiber-optic pins to measure the shock timing and profile, pyrometry to measure the temperature of the shocked surface, and, as on the other subcritical experiments, a measurement of the energy release from the experiment to verify lack of criticality.

Cimarron measured the ejecta properties of ? Separate Pu + HE package.