lation of sodium through small leaks in the heat exchange system.

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Effects of Explosive Shock Waves on a Gold-Silver Alloy

A gold-silver alloy was deformed by explosive loading at shock pressures up to 510 kbars. The stored energy and hardness increased over the whole range of pressures; the largest rates of increase were observed between 120 and 150 kbars. In this range, markings characteristic of deformation twins first appeared; higher pressures produced markings in all grains. These effects are compared with those of conventional deformation processes and are discussed in relation to probable structural changes.

A. S. Appleton
G. E. Dieter
M. B. Bever

In recent years, increasing efforts have been devoted to the investigation of the effects produced in metals by the passage of high-intensity shock waves of explosive origin. By properly utilizing the energy released by the detonation of a high explosive, it is possible to generate pressure pulses of the order of 500 kbars and higher. (One kbar equals 10^9 dynes per sq cm or approximately 1000 atm.) The passage of a shock wave through a metal occurs at pressures which are very much greater than the yield strength. As the shock front passes a point in the metal, the pressure rises almost instantaneously, and continues to act at the point for a few microseconds. Thus, metals subjected to explosive shock loading experience a nearly instantaneous increase in pressure, and a subsequent release of pressure, which is almost as rapid. Under these conditions mechanical twinning and shear transformations occur readily.

A. S. APPLETON, formerly with Department of Metallurgy, Massachusetts Institute of Technology, Cambridge, Mass., is presently with Department of Metallurgy, University of Liverpool, Liverpool, England. G. E. DIETER, Member AIME, is Research Project Supervisor, Engineering Research Laboratories, E. I. duPont de Nemours & Co., Wilmington, Del. M.B. BEVER, Member AIME, is Professor of Metallurgy, Massachusetts Institute of Technology.

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Smith[1] has investigated the metallurgical changes in copper and iron resulting from exposure to explosive shock waves. He found an appreciable increase in hardness in both metals. In copper, a hardness greater than that resulting from 95 pct reduction in thickness by rolling was obtained, yet in the explosive deformation, the thickness of the specimen decreased only a few percent. After explosive loading, the microstructure of copper showed markings characteristic of mechanical twins.

The amount of stored energy resulting from explosive loading is of interest. Measurements of the stored energy of cold work as a function of strain, temperature, strain rate, and composition have been made with gold-silver alloys deformed by rolling,[2] orthogonal cutting,[3] drilling,[4] filing,[5] wire drawing,[6] and torsion.[7] The investigation reported here was also carried out with a gold-silver alloy and its results can be compared with those for the deformation of this alloy by more conventional methods.

EXPERIMENTAL PROCEDURES

An alloy containing 82.6 wt pct Au and 17.4 pct Ag was purchased in several batches from Handy and Harman Co., New York, as annealed rod 1/4 in. diam. The rod was cold-rolled to a sheet approximately