H. J. Hall

Phase Transformations, pressure effect on

Pressure Required for Transformation Twinning in Explosively Loaded Low-Carbon Steel

Technical Note

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A series of wedges of 1020 steel (2 1/2 by 6 by 8 in.) were explosively loaded, as shown in Fig. 1. A slab of explosive on the surface of the steel wedge was initiated simultaneously along one edge, producing an essentially two-dimensional oblique shock in the metal. Pressure and density in the metal were measured as a function of distance from the explosive-metal interface by a method described elsewhere.[1] While for pressures below 130 kbars the technique produces accurate results, for greater pressures the presence of two shock waves in the metal[2,3] makes interpretation of the data uncertain. However, the location of the transition in pressure at 130 kbars can be readily identified from the data. The assumption of a single shock in the region above 130 kbars overestimates the pressure computed on a multiple-shock model.

After firing, the wedges were sectioned, lapped, and etched with 2 pct Nital. A photograph of an etched specimen is shown in Fig. 2. The specimens were examined metallographically. The dark region, at the top of the specimen, was heavily banded, Fig. 3, while the lighter area was comparatively free from banding, Fig. 4, the boundary between the two regions being quite abrupt. The very light regions at an angle of about 45 deg to the explosive-metal interface show virtually no banding. The origin of these light regions, which are not Luder's bands, is not yet explained.

The thickness of the heavily banded area was measured and compared with the pressure at the boundary between the heavily and lightly banded regions. The results of these measurements and calculations are given in Table I. For all shots, the pressure at the boundary is approximately the same

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