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SHOCK COMPRESSION OF POWDERED SiO_2, Mg_2SiO_4, $ZrSiO_4$ AND OTHER MATERIALS

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Phase-transformation in shock-compressed solids has been studied by many scientists in the last few years. Geologists hoped to apply these investigations to the theory of solid-state transformation in the Earth's mantle (DOBRETSOV *et al.*, 1968; DERIBAS *et al.*, 1966; RINGWOOD *et al.*, 1967; MCQUEEN *et al.*, 1967) but the specificity of shock compression prevents the realization of this idea at present. However, experiments in shock compression of geological materials are interesting in themselves. These experiments may be particulary useful for the general theory of solid-state transformation and for meteorite problems.

1. Methods of shock compression

The methods of shock compression with shocked material preservation have been described in BATSANOV *et al.* (1965) and DERIBAS *et al.* (1967). Theoretical investigations and direct observations show the possibility of the existence of a three-shock configuration in the axial part of the compressed material in the experiments with cylindrical containers (ADADUROV *et al.*, 1967). A photograph of shock configuration obtained by the optical method in (ADADUROV *et al.*, 1967) is shown in fig. 1. The existence of a steady three-shock configuration allows the determination of the pressure in the axial zone. For this case the Hugoniot's curve determines the pressure behind the plane shock wave propagating with the detonation velocity. The corresponding values of pressure for the two types of explosive used are given in table 1.

Evidently, the possibility of the existence of a three-shock configuration depends on the correlation of the sizes of explosive charge and that of the container, as well as of the composition and density of powder and other factors. In the case when there is no steady plane shock wave in shocked powder, the determination of pressure, temperature and density become very complicated.

Usually in shock-compression processes the pressure increases in a time of about 10^{-8} sec and decreases in

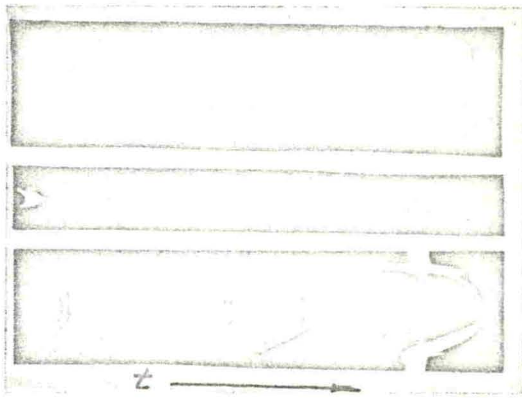

Fig. 1. Formation of three-wave configuration in cylindrical case.

TABLE 1

Pressure (in kbars) in the axial zone of containers in front of the head wave for different substances

Explosive	Explosive density g/cm^3	Rate of detonation km/sec	Substances and their density (g/cm^3)					
			SiO_2 (quartz) 2.60	SiO_2 (glass) 2.20	SiO_2 (powder) 1.6	Mg_2SiO_4 (powder) 3.05	$MgSiO_3$ (powder) 2.71	TiO_2 (crystalline) 4.25
Hexogene	1.1	6.6	480	490	420	—	510	—
Trotile/hexogene 50/50	1.6	7.6	680	680	—	660	—	800