illustrated by Fig. 3b (this figure pertains to the case when the wave propagation direction is the same as that of the electron drift). If the wave pulse (which is approximately one-eighth as long as the drift-field pulse) is located at region 1 or 3 of the drift-field pulse, then the wave is absorbed. The absorption in region 3 is larger by several decibels than in region 1. The amplification region is located between these two regions.

The wave gain can apparently be increased by producing molecular attraction between the contacting plates. There was no such attraction in our case.

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REGISTRATION OF DEBYEGRAM OF AMUMINUM COMPRESSED BY A SHOCK WAVE

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The possibility of using an x-ray pulse of duration $\sim 10^{-7} - 10^{-6}$ sec to register interference patterns of polycrystals has been demonstrated in [1 - 3], where data are also given on the efficacy of the means used to register soft x-rays when various types of x-ray sources are used. The noticeable recent progress in the development of this procedure make it suitable for x-ray structure investigation of substances compressed by shock waves.

We present here experimental results of the registration of an x-ray debyegram of aluminum compressed by a shock wave. We registered a section of the Debyegram with reflections from the atomic planes (111) and (200). We used K_α Mo radiation (λ = 709 Å) and an exposure time $\sim 6 \times 10^{-7}$ sec. The x-rays reflected from the samples were registered with a high-sensitivity x-ray film with

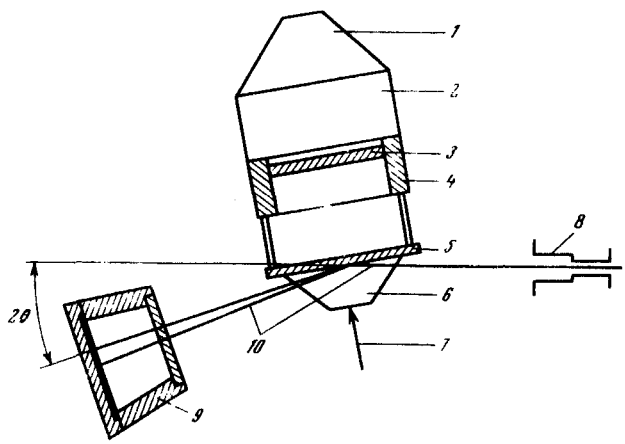

Fig. 1. Arrangement of apparatus for the registration of debyegrams of aluminum compressed by a shock wave: 1 - lens for producing a plane shock wave, 2 - explosive charge, 3 - aluminum striker, 4 - lead nozzle, 5 - investigated sample, 6 - lithium support plate, 7 - electric contact to record the instant when the shock wave emerges to the surface of the lithium plate and needed to synchronize the x-ray exposure with the required phase of dynamic loading of the sample, 8 - collimator, 9 - protected cassette with x-ray film, 10 - path of x-ray beam.

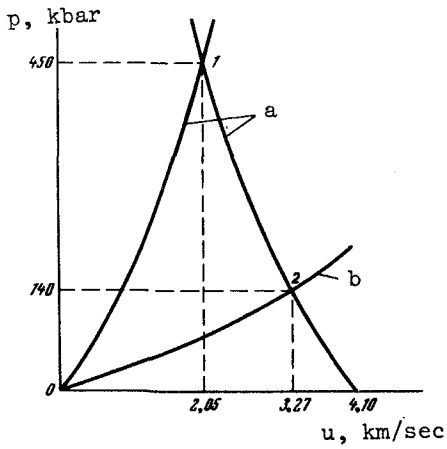

Fig. 2

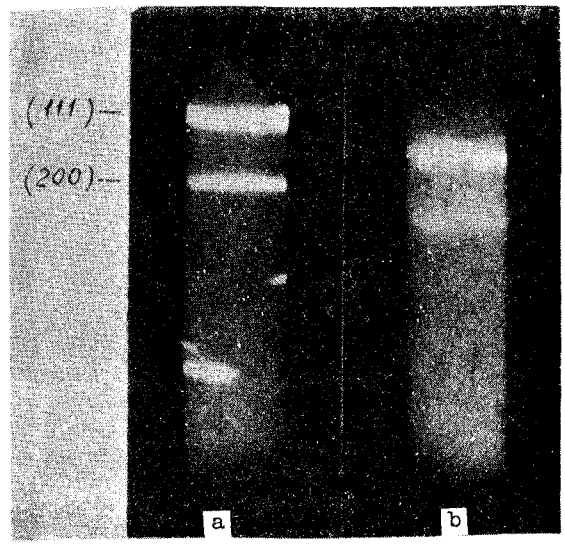

Fig. 3

Fig. 2. Dynamic compression of aluminum as a plot of pressure (u) vs. mass velocity (p): a - shock adiabat of aluminum, b - shock adiabat of lithium. 1) State of sample and striker upon collision. 2) State of sample during the x-ray photography.

Fig. 3. Debyegram of aluminum with reflections from the crystallographic planes (111) and (200): a - preliminary photograph (unloaded sample), b - photograph of sample compressed by the shock wave.

intensifying screens. The range of the registered angles on the 2θ scale was 20°. Figure 1 shows the experimental setup used to obtain the x-ray structure photographs. The aluminum plate is accelerated by the explosion products to w = 4.1 km/sec and is stopped by the investigated sample (5), producing in it a shock wave with a maximum pressure amplitude of 450 kbar. The shock wave splits on the boundary between the sample (5) and the lithium plate (6) into a shock wave of 140 kbar intensity propagating in the lithium and a rarefaction wave propagating in the sample and reducing the pressure to the same value as in the lithium. Figure 2 illustrates the dynamic compression of the sample by a plot of the pressure against the mass velocity[1]). Point (1) on Fig. 2 corresponds to the states produced in the sample and in the striker when they collide, and point (2) corresponds to the state of the sample after its relaxation by the lithium. The x-ray structure photographs of the aluminum were taken in this state. Estimates have shown that the aluminum loading pressure (p = 140 kbar) persists in our case for a time $\sim 1.5 \times 10^{-6}$, which is approximately double the exposure time of the x-ray generator [3] and makes it possible to use the photography technique described in that reference. The x-ray structure photographs of the shock-wave-compressed samples were taken through the lithium plate (6) (Fig. 1).

Figure 3 shows two debyegrams of aluminum. On the left is a preliminary picture (unloaded sample) and on the right a picture obtained under pressure. The difference in terms of the angle 2θ between the corresponding reflections on the explosion and preliminary pictures is a sum of two parts. The first corresponds to the change of the crystal-lattice parameter of the aluminum compressed by the shock wave, and the second corresponds to the kinematic drift of

[1]) The data on the dynamic compressibilities of aluminum and lithium were taken from [4, 5].

the x-ray beam reflected from the sample moving with mass velocity u = 3.27 km/sec (Fig. 2). The contribution of the second part can be made equal to zero by turning on the x-ray exposure at the instant when the shock wave arrives at the contact boundary of the aluminum and the lithium plate. In the experiment reported here, the x-ray exposure was effected $\sim 0.5 \times 10^{-6}$ sec later, so that the contributions of the two effects to the deflection of the x-ray beam on the explosion picture were approximately equal.

We note in conclusion that the existence, behind the shock-wave front, of a crystalline order sufficient for the registration of x-ray diffraction patterns was confirmed also for the ionic compound LiF in a recent communication [6]. Obviously, the time during which the crystal structure assumes a new equilibrium state is short compared with the employed x-ray exposure times.

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MIXED EXCHANGE INTERACTION IN FCC IRON-PALLADIUM ALLOYS

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The method of small-angle inelastic scattering of neutrons by spin waves, which is based on measuring the limiting scattering angle (θ_0) [1, 2], permits the determination of the sign and magnitude of the exchange-interaction integrals between the different pairs of atoms in alloys. The possibilities of this method were first demonstrated with fcc iron-nickel alloys as an example [2], and the previously proposed [3] antiferromagnetic interaction between the iron atoms was experimentally demonstrated there.

It is known that iron-palladium alloys exhibit properties that are analogous in many respects to those of iron-nickel alloys. In particular, they also have invar properties. It was therefore of interest to study the parameters of the exchange interaction in this system.

We have performed a complete investigation of small-angle inelastic magnetic scattering by spin waves in concentrated iron-palladium alloys with 25, 40, 50, 60, 64, 66, 68 at.% iron. The alloys were smelted with pure components in vacuum and went through a homogenizing annealing for 100 hours. To obtain the disordered state, the alloys were ground into a powder, which was then pressed into tablets of 20 mm diameter and 3 - 5 mm thick. The powders in which the deformation martensite was produced were quenched in oil from 1100°C to obtain a single-phase state. An investigation of the x-ray diffuse background at the location of the superstructure reflection showed that there was no long-range order whatever in the samples. The short-range order, however, remained.