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Modern ultrahigh-pressure investigations necessitate the calibration of the equipment with respect to pressure, which can be most conveniently performed by measuring the electric resistivity of metals under pressure. The pressure scale used for this purpose is most often composed on the basis of fixed points of known transition pressures in metals, namely, BiI - BiII, TlI - TlIII, CsII - CsIII and BaII - BaIII. The pressures of these transitions were borrowed from Bridgman's paper [1], where the electrical resistivities of 72 elements, alloys, and compounds were measured as functions of pressures of up to 10^5 kg/cm². The values of transition pressures in Tl, Cs, and Ba which were determined by Bridgman with respect to the volume jump in studying compressibility [2, 3] do not coincide with Bridgman's data that are given in the tables of paper [1]. This fact was repeatedly mentioned in various papers, especially in papers describing calibrations. The data published by Kennedy and La Mori [4] concerning the transition pressures in the same elements are in good agreement with the values of pressures of these transitions that were determined by Bridgman with respect to volume jumps. In connection with the discrepancy between these new data and the data from [1], the problem of the "new" and "old" pressure scales (according to data by Kennedy and La Mori and by Bridgman, respectively) is being discussed lately in periodicals, while preference is explicitly given to the first of these scales.

However, the difference between the results given by Bridgman in [1] and the results given in other papers, in particular, in measuring volume compressibility, was nowhere clearly defined until now. While most of Bridgman's data as well as data given by Kennedy and La Mori represent mean values, determined by averaging the data obtained in raising and lowering the pressure, Bridgman

Values of Transition Pressures in Tl, Cs, and Ba, kg/cm²

Element	Bridgman [1]			Bridgman [2, 3]	Kennedy and La Mori [4]
	tabular data (pressure rise)	pressure reduction	average values		
Tl	45000	28000	36500	40000	37400
Cs	55000	32000	43500	45000	42600
Ba	80000	60000	70000	60000	60000

offers in [1] as final results only the measurements performed for rising pressure, explaining this by the considerably lower determinancy of the pressure measured while it is being reduced. Bridgman himself indicated that the values of the transition pressures which he determined with respect to the jump of the electrical resistivity may greatly differ from the previously determined average values in connection with the presence of hysteresis in these transitions.

Bridgman wrote the following concerning the transition to cesium: "It seems to me that the large difference between the rising and falling pressures in electron transition must be attributed to an actual effect - most transitions occur only with a considerable disturbance of the thermodynamic equilibrium values" [1] (p. 191). Later on, other authors have apparently forgotten this statement, and they tried to explain the above discrepancy by possible errors in the pressure determinations in [1]. However, if one takes into account the transition pressure values obtained while reducing the pressure that are given in [1], the average values are in good agreement with data by Kennedy and La Mori as well as with Bridgman's previous data (see table).

Thus, the discrepancy between the results of electric and volumetric measurements is basically due to the fact that the pressure values corresponding to the transition to a denser modification are given in the first case, while the arithmetic means of the transition pressures determined while raising and lowering the pressure are given in the second case.

Therefore, from a comparison of the two pressure scales, it is difficult to conclude whether the "old" pressure scale that is based on data from [1] is correct or incorrect. Moreover, the experiments in [4] were performed by means of a device where special measures were taken in order to reduce hysteresis, which, unfortunately, as a rule, cannot be done in the equipment ordinarily used. The latter fact certainly must be taken into account if the data given by Kennedy and La Mori are used as reference points in calibration, since their investigations were performed mainly under rising pressure conditions.

LITERATURE CITED

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USE OF THE EG CAMERA FOR KINEMATIC ELECTRON DIFFRACTION PHOTOGRAPHY

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The adaptation of the EG electron diffraction camera for kinematic photography is described. For studying processes occurring at different rates, provision is made for varying the displacement velocity of the plate in four steps. The sharpness of lines and the resolution are not inferior to those in ordinary electron diffraction patterns, and they are sometimes even higher. The specimen is fastened on a tantalum heater, which is heated by current to 600°C during photographing. The distorting effect of the current's magnetic field on the diffraction pattern has been eliminated.

The described method was used for investigating the Cu - Se, Bi - Se, and Ni - Se systems. We identified the phases that developed at the beginning of the process and the phase transitions occurring during the annealing of the specimen in vacuum, which are explained by the evaporation of selenium.

In comparison with x-ray waves, the characteristic property of electron waves is their intensive scattering by the material. Due to this property, the exposure time of electron diffraction patterns is measured in seconds, while the exposure time of roentgenograms is measured in hours. This makes it possible to record continuously the diffraction pattern on a moving photographic plate or film, i.e., to produce kinematic electron diffraction patterns. By using such electron diffraction patterns, we are able to follow changes in the specimen under investigation while it is heated and to study in detail and without missing the intermediate states the processes of crystallization, reactive diffusion, phase formation, and phase transformation in thin layers.

In [1, 2], special equipment was used for producing kinematic electron diffraction patterns of thin films and for studying the phase transitions in the Cu - Al system as well as the crystallization of germanium layers obtained by evaporation. The principles of this method and some critical estimates of its possibilities were briefly presented in [3]. By using the horizontal EG electron diffraction camera [4], we developed a simple method for producing kinematic electron diffraction patterns [5], and we investigated the processes of phase formation and phase transformation in certain binary systems.

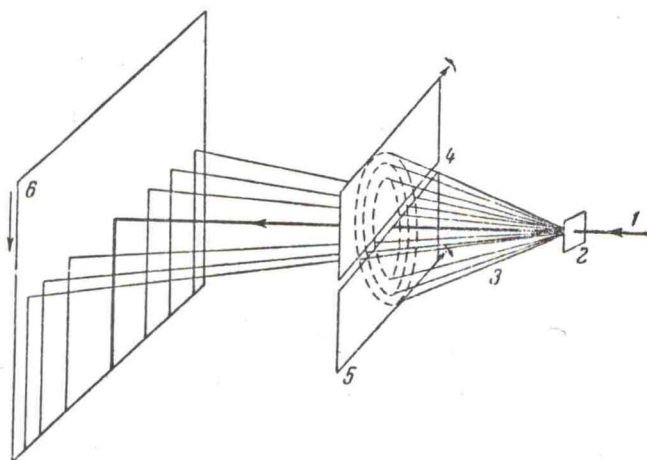


Fig. 1. Arrangement for kinematic photography. 1) Electron beam; 2) specimen; 3) diffraction cone; 4) slit; 5) shutter; 6) moving photographic plate.