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Re-examination of the symmetries of iron and nickel by the powder method.

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Recently, Kochanovska (1949) determined the lattice constant of iron from several reflecting planes in iron, and reported that she had found a significant difference between the measured values for the different planes above 250° C. She attributed her findings to a deviation from cubic symmetry. Because we do not believe that a deviation of the iron structure from cubic symmetry would result in the differences in lattice constant observed by her and because, in any case, the magnitude of the deviation is far larger than that expected from magnetostricture measurements, we have repeated her measurements. Similar measurements were made also on nickel, since any magnetic distortion of the lattice would, perhaps, be expected to be larger for nickel.

Lattice constants were determined at room temperature, using Jette & Foote's (1935) modification of Cohen's method. The {310}, {211}, and {220} reflections of iron were obtained on the same film by interchanging X-ray tubes with different target materials during exposure. The {420}, {331}, {222} and {400} planes of nickel were similarly recorded together. No systematic dependence of the lattice constant on h, k and l could be observed other than the $\varphi \sin 2\varphi$ dependence which is interpretable in terms of geometric and adsorption errors. The final lattice parameters adjusted to 25° C. are:

$$\text{Iron: } a_0 = 2{\cdot}8665 \pm 0{\cdot}0001 \text{ Å.*}$$
$$\text{Nickel: } a_0 = 3{\cdot}5238 \pm 0{\cdot}0003 \text{ Å.*}$$

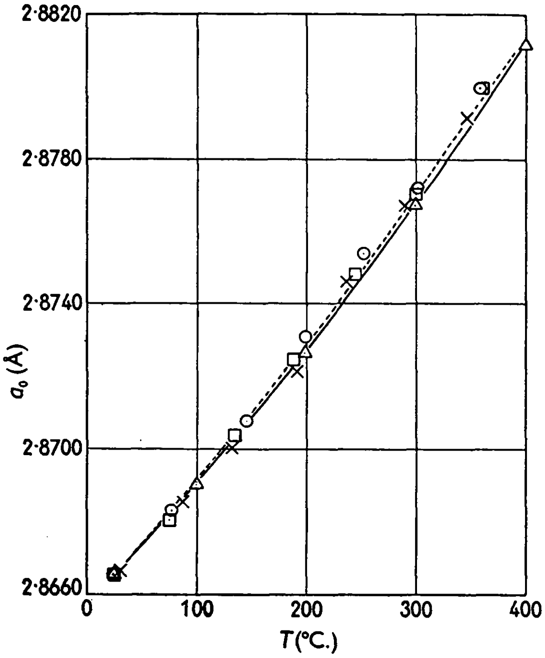

Fig. 1. Plot of lattice constant as a function of temperature for iron. Circles: 310 plane; Co radiation. Squares: 211 plane; Cr radiation. Crosses: 220 plane; Fe radiation. Triangles and full line: Austin & Pierce's (1934) data. Broken line: adjusted experimental data.

Measurements of lattice constants at higher temperatures were made from films exposed in a flat-plate back-reflection camera with a 0·01″ pinhole, which was positioned to place the required diffraction ring on the focusing circle. Lattice constants for the above mentioned planes were obtained in the temperature range 24–362° C. for iron and 24–455° C. for nickel. The high-temperature lattice constants were standardized by recording a room-temperature diagram on a sector of each film. The results so obtained agree well with the mean linear expansion coefficients reported by Austin & Pierce (1934) for iron and by Jordan & Swanger (1930) for nickel. A curve showing our data together with those of Austin & Pierce for iron is given in Fig. 1. The deviation of individual points from either of the curves lies well within our experimental error (±0·0005 Å). We conclude that there is no significant difference among the lattice constants of iron calculated for the various planes at any temperature. Thus our results do not support Kochanovska's conclusion that deviation from cubic symmetry develops in iron as the temperature is raised or that the deviation can be observed by X-ray techniques.

Similar results have been obtained for nickel.

References

Austin, J. B. & Pierce, R. H. H. Jr. (1934). *Trans. Amer. Soc. Metals*, **22**, 447.
Jette, E. R. & Foote, F. (1935). *J. Chem. Phys.* **3**, 605.
Jordan, L. & Swanger, W. H. (1930). *Bur. Stand. J. Res., Wash.* **5**, 1291.
Kochanovska, A. (1949). *Physica*, **15**, 191.

* All units are Ångström units. The wavelength values used were:

	$K\alpha_1$	$K\alpha_2$
Cr	2·28962 Å	2·29352 Å
Fe	1·93597	1·93991
Co	1·78890	1·79279
Ni	1·65783	1·66168
Cu	1·54050	—

Notes and News

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