On the "Precursory Recrystallization" of Metals

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The present research aims to be a continuation of our foregoing X-ray investigation "On the Structural Change of Mechanically Pulverized Iron Powder due to the Procedures of Annealing" (Rev. Phys. Chem. Japan, dedicated to Prof. S. Horiba, (1947), 86). From the results of the aforesaid investigation, it became clear that the recrystallization in the specimens of iron powder prepared mechanically to be used for the sintering procedure, vigorously takes place in two distinct temperatures: i.e., the remarkable growth of crystal grains in the specimens was detected to occur not only at the recrystallization temperature of iron (about 600° C), but at a certain temperature (350°-450° C) far below than the recrystallization temperature, at an intermediate temperature the size of crystal grains remaining almost unaltered. Furthermore, such a peculiar phenomenon as may be called a "Precursory Recrystallization" at comparatively low temperature, was inferred to take place commonly to all the specimens of metals undergone a severe inner strain.

To make clear whether the above inference were correct or not, X-ray examination on the process of the structural change due to the procedures of annealing, was repeated in the present research, with several specimens of iron and nickel foils obtained by rolling the annealed plates of electrolytic iron or nickel of the thickness 0.5mm. in various degree. As the consequence of this examination, the aforesaid "Precursory Recrystallization" phenomenon was seen also to occur, in some iron and nickel foils, which have so severely been enrolled that their thickness was reduced less than 10μ, e.g., it could be confirmed from the Laue patterns obtained with these foils, that the common axis of the fibrous structures in iron foils, which has initially been situated parallel to the direction <211>, converts to coincide with the direction <110>, by heating about 420° C; while in nickel foils, its direction changes from <111> to <110> at a temperature 470° C far below than the recrystallization temperature of nickel (about 700° C). It must be postscribed that as a matter of fact, such a peculiar phenomenon could never be observed with the specimens of both metals, which had not been worked so severely as above described. (Received July 30, 1948).