The Relation between Displacive Disorder, Premartensitic Instabilities and the Martensitic Transformation in β-Cu–Zn Alloys

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A Study on the Fine Structure in Metastable β₁ Crystal of Cu–40 wt. % Zn Alloy

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Previous investigations have revealed that the metastable β₁ crystal of Cu–40 wt. % Zn alloy, retained from the high-temperature range by quenching, was easily transformed martensitically [Sato, S. & Takezawa, K. (1968). Proc. Int. Conf. on the Strength of Metals and Alloys, Suppl. to Trans. AIME, J. Inst. Metals, 9, 925–929] or bainitically [Takezawa, K. & Sato, S. (1972). Kinzoku Gakkaishi (J. Japan Inst. Met. in Japanese), 35, 469–475] to the long-period close-packed crystal. In the course of the above investigations, very fine contrast was often observed in the transmission electron microscopic image of untransformed β₁ regions. The contrast was thought to be produced by the fine transformation product in the matrix. But no further study on this structure was performed at that time. In the present work, a detailed analysis of the various diffraction patterns containing additional spots has been made in order to determine the crystal structure of the fine product in the matrix. The obtained structure is orthorhombic with \( A = (2a/3), [\overline{1}12]_β, B = (a/2) [\overline{1}11]_β \) and \( C = a [110]_β \), which is also considered as a distorted h.c.p. structure. The relation between the product and the martensite or the bainite was examined by respectively cooling or heating the quenched specimen in an electron microscope. The \( (110) [\overline{1}10] \) shears play an important role in producing the product. The products may be thought as the embryos of close-packed structure, which are transformed by a mechanism similar to that of Burgers for the martensitic transformation from b.c.c. to h.c.p.