- ¹⁰ W. Betteridge: *Journal Inst. of Metals* (1953-1954) **82**, p. 149.
- ¹¹ H. G. Muller: *Ztsch. für Physik* (1930) **60**, p. 464.
- ¹² M. Kornfeld and W. Pavlov: *Physik Ztsch. Sowjetunion* (1934) **6**, p. 537; (1937) **12**, p. 658.
- ¹³ S. F. Reiter: *Trans. AIME* (1952) **194**, p. 972; *JOURNAL OF METALS* (September 1952).
- ¹⁴ D. Turnbull: *Trans. AIME* (1951) **191**, p. 661; *JOURNAL OF METALS* (August 1951).
- ¹⁵ H. Kanzaki: *Journal Physical Soc., Japan* (1951) **6**, p. 90.
- ¹⁶ G. Borelius, S. Berglund, and S. Sjöberg: *Arkiv för Fysik* (1953) **6**, p. 143.
- ¹⁷ V. A. Phillips and A. Phillips: *Journal Inst. of Metals* (1952-1953) **81**, p. 185.
- ¹⁸ J. E. Burke and D. Turnbull: *Progress in Metal Physics* (1951) **3**, p. 220.
- ¹⁹ W. A. Johnson and R. F. Mehl: *Trans. AIME* (1939) **135**, p. 416; *METALS TECHNOLOGY* (August 1939).
- ²⁰ M. Avrami: *Journal of Chemical Physics* (1939) **7**, p. 1103; (1940) **8**, p. 212; (1941) **9**, p. 177.
- ²¹ J. K. Stanley and R. F. Mehl: *Trans. AIME* (1942) **150**, p. 260; *METALS TECHNOLOGY* (February 1942).
- ²² A. Krupkowski and M. Balicki: *Annalen Akademie Sic. Tech. Varsovie* (1937) **4**, p. 270.
- ²³ N. Thorley: *Journal Inst. of Metals* (1950) **77**, p. 141.
- ²⁴ P. C. Varley: *Journal Inst. of Metals* (1948-1949) **75**, p. 185.
- ²⁵ W. H. Hall and G. K. Williamson: *Proceedings Physical Soc. B* (1951) **64**, p. 937.
- ²⁶ G. K. Williamson and W. H. Hall: *Acta Metallurgica* (1953) **1**, p. 22.
- ²⁷ S. Harper: *Physical Review* (1951) **83**, p. 709.
- ²⁸ A. H. Cottrell: *Dislocation and Plastic Flow in Crystals*. (1953) Oxford. Oxford University Press.
- ²⁹ P. Laurent and N. Batisse: *Révue de Metallurgie* (1952) **49**, pp. 485, 593.
- ³⁰ T. Suzuki: *Science Reports of the Research Inst. Tôhoku University, Japan* (1949) **1**, p. 193.

Technical Note

On the Casting, Rolling, and Annealing Textures of Chromium

by W. H. Smith

IN the course of an investigation on chromium containing minor amounts of alloying elements, the information herein has been obtained on the crystallographic orientations resulting from arc melting, rolling, and annealing.

The chromium used in this investigation was electrolytic flake obtained from the Electro Metallurgical Co. This material was heated for 20 hr at 1600°C in hydrogen with a dew point of about -100°C. The oxygen and nitrogen content of the chromium after this treatment was 0.0003 pct O and 0.005 pct N.

Five pounds of this chromium were arc melted in a water-cooled copper crucible. After arc melting, the oxygen and nitrogen contents were 0.002 and 0.025 pct, respectively. A section of this ingot is shown in Fig. 1. By means of a back-reflection Laue technique, the crystal habit of the cast ingot was determined. As expected, it was found that the [100] was approximately the axis of the columnar grains. In this respect, chromium behaves like other body-centered-cubic metals in that a cubic axis is normal to the cold surface of the mold.

W. H. SMITH is associated with Alloy Studies Research, Research Laboratory, General Electric Co., Schenectady, TN 272E. Manuscript, Oct. 25, 1954.

Fig. 1 — Section through arc-melted chromium ingot is shown.

A slab cut from this ingot was rolled at 600°C as follows: four 30 pct reductions were made with intermediate anneals at 1200°C for 15 min. Rolling was done with the [100] of the columnar grains in the rolling direction. Following the final anneal, an 80 pct reduction was taken at 600°C. The final sheet thickness was ten mils. By polishing and etching, the thickness was reduced to four mils and the grain orientation determined by the transmission Laue method using molybdenum radiation with a zirconium filter. Fig. 2 is the (110) pole figure for this material with the ideal (100)[011] and (111)[112] orientations indicated.

The grain orientation of sheet rolled 40 and 80 pct in the same direction as before at 600°C followed by recrystallization at 1200°C for 15 min was determined by a back-reflection Laue technique. A random texture was found in both cases. This 1200°C 15 min anneal was found to give complete recrystallization and some grain growth.

Fig. 2—(110) pole figure is for chromium reduced 80 pct at 600°C. Ideal orientations are indicated as follows: square, (100) [011] and triangle, (111) [112].