

bana type" and the cathode is a simple spiral of pure tungsten wire, and the total input power at 10 KV anode voltage and without magnetic field is 4 KW. We have attained the oscillation at 9 KV anode voltage and 700 Gauß magnetic field, and the continuous output power 500 W at 146 cm. length. We have obtained the expectation that the output power higher than 1 KW is possible with the same construction. For the simplification and the improved efficiency we have constructed a dipole antenna within the magnetron, so that the feeders need not penetrate the wall of the magnetron.

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#### 4. On the Absorption Spectra of $C^{12}H_2O^{16}$ at the 6-mm. and 4-mm. Wave Length

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The authors have derived the second and the third harmonic waves from the fundamental wave of the klystron 2K33A whose wave length is 1.2-cm., by using the frequency multiplier which we devised and reported at the Annual Meeting of the Physical Society of Japan in 1951.

We have observed the absorption lines of  $O^{16}C^{12}S^{32}$  ( $J=3 \rightarrow 4$ ,  $\nu=48,651.64$  Mc/s,  $\alpha=4.4 \times 10^{-4} \text{cm}^{-1}$ ), and several lines of  $C^{12}H_2O^{16}$ .

Though R.B. Lawrance and M.W.P. Strandberg have made measurements on the spectra of  $CH_2O$ , there are yet unobserved lines in millimeter range of this sample. We have detected the line corresponding to  $J_{K-1}^{K=11}$ ,  $K=11$ ,  $2,10 \rightarrow 11$ ,  $2,9$  ( $\nu=48,600$  Mc/s  $\alpha=8 \times 10^{-5} \text{cm}^{-1}$ ), and now are observing the lines  $12 \rightarrow 12$  (6-mm. range) and  $19 \rightarrow 19$  (4-mm range), to compare these  $2,11$   $2,10$   $3,17$   $3,16$  with the theoretical values obtained by Heiner *et al.*

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#### 5. X-Ray Studies on Cast Structure of 4% Si-Steel in the Light of Anisotropy of the Velocity of Crystal Growth

Hideo TAKAKI, Masashige KOYAMA and Hidekiyo FUJIHIRA

(H. Takagi Laboratory)

It was found by one of the authors that the growing velocity of [001] was far larger than that of others in the preparation of Si-steel single crystals. On the other hand, it is well known that the growing direction of cast structure of metals which have the cubic structure, is always parallel to [001].

Therefore, it seems very interesting to study the relationship between the two phenomena above mentioned.

An X-ray examination was performed by both the Laue and the rotation methods on the view point above mentioned, utilising the heterogeneous X-rays emitted from Fe-anticathode. From the consequence of this X-ray examination on the cast structure of 4% Si-steel, the following facts were confirmed :

(1) The practical columnar structure of this Si-steel was very complex, since the condition was not so simple as in the preparation of single crystals.

(2) The direction of growth of perfect columnar crystals was parallel to [001] (Fig. 1).

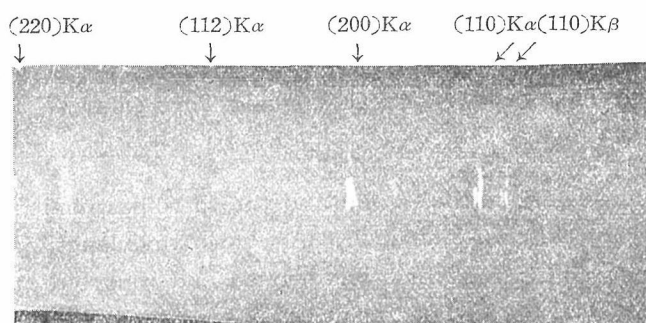


Fig. 1.

(3) At the ingot surface, very small crystals grown by severe supercooling were arranged at random. But it seemed that among these, the crystals, whose [001] directions were not parallel to that of thermal gradient, were gradually pushed away by the ones whose [001] directions were parallel during growth, and then the so-called columnar structure of [001] was finally formed at the inner part of ingot.

In addition to the X-ray examination above mentioned, most part of the crystals contained in specimen could be separated each other after the Si-steel plate, which was previously annealed at 800°C for 17 hrs. in air in order to diffuse the impurities contained in grain to the grain boundary, was electrolysed in the 1N potassium dichromate solution with current density of 0.4A/cm<sup>2</sup>. for 5 hrs. The length of the longest one among the crystals thus separated was 25mm.

The following facts were also observed.

(1) Although the microscopic structure should show only the ferrite at the equilibrium state, the result obtained showed unexpectedly the "Widmanstätten Structure" of pearlite, presumably owing to the partial super-saturation of carbon (Fig. 2). After this specimen was annealed at 850°C for 16 hrs. in air and then slowly cooled in the furnace, the pearlite structure was not observed.

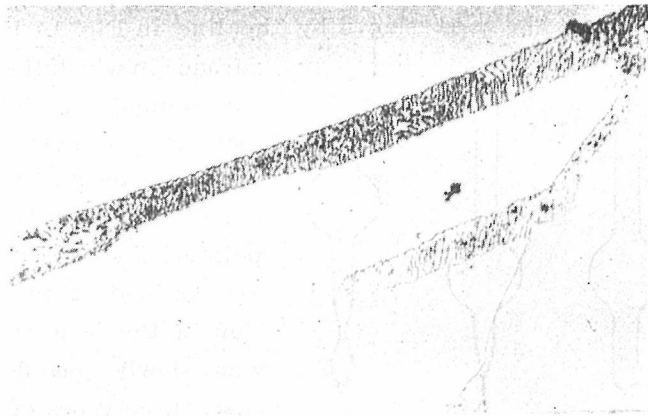


Fig. 2.  $\times 700$

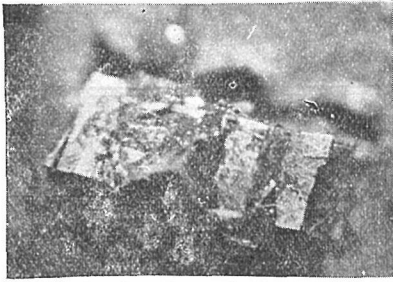


Fig. 3. Natural size.

(2) When the ingot was cut to take out specimens by acetylene gas, many cracks were induced in specimens thus obtained by thermal stress. One of these specimens was then divided by hammering along these cracks. The fracture thus formed was not intergranular but crystalline, and it was found by X-ray analysis that

the fracture planes were parallel to (100) or (112) (Fig. 3).

## 6. Studies on Anisotropy in the Velocity of Crystal Growth. (1)

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It was formerly found by one of the authors that the velocity of crystal growth was very different with respect to the crystal direction in nickel and silicon-steel. In this work, the spherical single crystal of tin, the melting point of which is far lower than that of materials above mentioned, was firstly prepared. As it seems that if the velocity of crystal growth of tin is different with respect to the crystal direction, the shape of spherical single crystal should be changed when it is immersed into the supercooled liquid tin the immersing experiment was carried out.

The results are briefly described below :

1) The glass mould shown in Fig. 1 was made from the glass tube of 8mm in diameter in order to prepare the spherical single crystals. After the melted tin (99.92 % in purity) was sucked into the glass mould, this