*Summary.*

Specific heats of tin were measured between 3.5 and 3.9° K., with heatings of the order of 0.01 degree. Between 3.70 and 3.72° K. the atomic heat decreases from a value of 0.0078 to a value of 0.0054. This change coincides with the transition of the supraconductive to the non-supraconductive state. A magnetic field that impedes the occurrence of supraconductivity prevents also the change in specific heat. Transition to the supraconductive state is not connected with a transformation heat.

Physics. — *The supraconductivity of gold-bismuth.* By W. J. DE HAAS and T. JURRIAANSE. (Communication N⁰. 220e from the KAMERLINGH ONNES Laboratory Leiden.)

(Communicated at the meeting of June 25, 1932).

W. J. DE HAAS, E. VAN AUBEL and J. VOOGD found, that the eutectic of the two non-supraconductive metals, gold and bismuth, becomes supraconducting at 1.84° K.

As is evident from the melting diagram of VOGEL [1]), this system consists of two phases viz. a solid solution with the gold lattice in which maximally 4 % Bi is solved and the pure bismuth ; fig. 1.
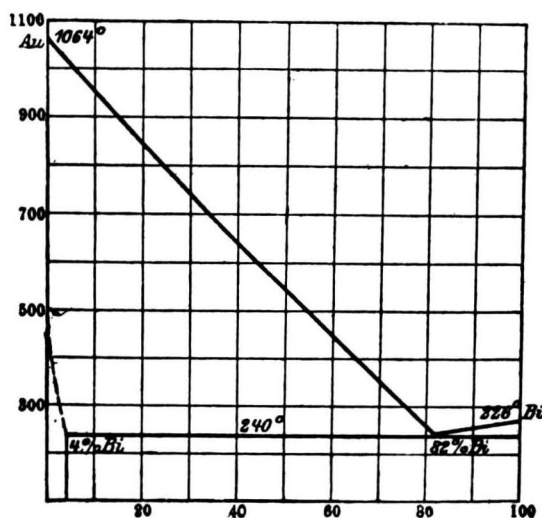
From these measurements the conclusion was drawn, that the supraconductivity was due to the gold phase [2]). To explain this behaviour of the gold-phase we may start from three hypotheses :

[1]) Zs. f. Anorg. u. allgem. Chem. **50**, 147, 1906.
[2]) Comm. Leiden No. 197c. These Proc. XXXII, p. 724.

1. Pure gold becomes supraconducting below the lowest temperature at which gold has been investigated. This implies an elevation of the transition point of more than 0°.8. This is rather improbable.

2. The melting diagram is wrong or a second crystal lattice exists.

3. The supraconductivity is purely due to the combination of these two non-supraconductors.

In this paper the investigations on this question will be discussed.

To test the first hypothesis we tried to find out by the Röntgenmethod of DEBIJE—SCHERRER, whether, in carefully tempered solid solutions, the lattice is strained to such a degree by the substitution of its atoms by the bismuth atoms that this might cause the great elevation of the transition point by 0.8 degree.

No change however was observed in the distances between the lines of the interference figure of the pure gold and of the solid solutions with a Bi concentration below 1 $^0/_{00}$.

At higher percentages of Bi e.g. 10 %, 20% and 40 % other lines occur than those of the gold lattice. According to the diagram of VOGEL these should be lines of the bismuth lattice. A comparison between photos of a solution 40 % Bi in gold and of pure bismuth showed that the new lines did *not* belong to the bismuth.

Evidently a third phase exists with a different crystal lattice.

A Röntgen photo of what VOGEL indicates as the eutectic gold-bismuth shows that this does not contain lines of the gold lattice and only bismuth lines and new lines.

The new phase can be separated from its eutectic with bismuth by washing away the bismuth with nitric acid.

Having done this we retain a fine powder and rather large crystals.

The chemical analysis by Dr. C. GROENEVELD gave a very constant composition with the formula Au_2Bi. Also the distance of the lines in the Röntgendiagram of the washed Au_2Bi powder and of the 10, 20, and 40 % solutions agreed within 1 $^0/_{00}$, so that we may assume that neither of the two components is soluble in the Au_2Bi. The structure analysis, too, gave the same result.

The Au_2Bi powder becomes supraconducting in liquid helium at just the same temperature as the eutectics and the solid solutions measured by DE HAAS, VAN AUBEL and VOOGD. Thus the new Au_2Bi-phase is the supraconductor in the system gold bismuth.

Angular measurements at the crystals taught that they were octahedral or crystal forms near these.

Rotation diagrams, after POLANYI—SCHIEBOLD, of some crystals round three mutually perpendicular axes gave the same interference figure, so that in fact the crystal is cubic. The edge is 7.94 Å.

The pycnometrically determined density is 15.46, so that we have 24 atoms per elementary cell. The röntgenographically determined density is 15.70.

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A rotation diagram with a face diagram as axis (110) gave a zone distance $\sqrt{2}$ times as large as that of a (100) diagram.

This is an indication of a face-centred-translation-lattice. Also the extinctions in the DEBIJE—SCHERRER diagram are in agreement with this. We have therefore a face-centred-cube lattice. A calculation of the intensities shows that only the space-group O^4 is possible with the following point-arrangement.

$$Au \begin{cases} {}^1/_8 \; {}^1/_8 \; {}^1/_8, \; {}^5/_8 \; {}^5/_8 \; {}^1/_8, \; {}^5/_8 \; {}^1/_8 \; {}^5/_8, \; {}^1/_8 \; {}^5/_8 \; {}^5/_8, \; {}^1/_8 \; {}^7/_8 \; {}^7/_8, \; {}^5/_8 \; {}^3/_8 \; {}^7/_8, \\ {}^5/_8 \; {}^7/_8 \; {}^3/_8, \; {}^1/_8 \; {}^3/_8 \; {}^3/_8, \; {}^7/_8 \; {}^1/_8 \; {}^7/_8, \; {}^3/_8 \; {}^5/_8 \; {}^7/_8, \; {}^3/_8 \; {}^1/_8 \; {}^3/_8, \; {}^7/_8 \; {}^5/_8 \; {}^3/_8 \\ {}^7/_8 \; {}^7/_8 \; {}^1/_8, \; {}^3/_8 \; {}^3/_8 \; {}^3/_8, \; {}^3/_8 \; {}^7/_8 \; {}^5/_8, \; {}^7/_8 \; {}^3/_8 \; {}^5/_8 \end{cases}$$

$$Bi \begin{cases} {}^1/_2 \; 0 \; 0, \; {}^1/_2 \; {}^1/_2 \; {}^1/_2, \; 0 \; 0 \; {}^1/_2, \; 0 \; {}^1/_2 \; 0, \\ {}^3/_4 \; {}^1/_4 \; {}^1/_4, \; {}^3/_4 \; {}^3/_4 \; {}^3/_4, \; {}^1/_4 \; {}^1/_4 \; {}^3/_4, \; {}^1/_4 \; {}^3/_4 \; {}^1/_4 \end{cases}$$

The second possible point-arrangement is the above one displaced over half an identity period. Thus the gold and bismuth atoms are situated at points non-equivalent for the structure and therefore not statistically distributed, so that we can speak of Au_2Bi combination in which neither gold nor bismuth is soluble. We have, therefore, to do with a singular kind of crystal, which is in good agreement with the very low magnetic threshold value [1]) of the gold-bismuth. This is of the same order of magnitude as that of the pure supraconductors [2]). Until now always high magnetic threshold values have been given for solid solutions.

The results of the measurements and a complete discussion of the structure will appear in the next communication.

[1]) Comm. Leiden No. 214b. These Proc. XXXIV, p. 56.
[2]) Comm. Leiden No. 191b. These Proc. XXXI, p. 687.

Chemistry. — *Oxidation of phenol with peracetic acid. (Contribution to the knowledge of the substitution of benzene).* By Prof. J. BÖESEKEN.

(Communicated at the meeting of June 25, 1932).

Some years ago G. SLOOFF and one of us (B.) discovered that at the oxidation of naphtalene with peracetic acid a very considerable quantity of o-carboxy-cis-cinnamic acid is produced. So one of the benzene-rings of the naphtalene is opened, by which probably the naphtalene o-chinone as intermediate product is formed, because this is quantitatively oxidized by peracetic acid to o-carboxy-cis-cinnamic acid. (By the way we remark that this does not prove that in naphtalene there are one ring of benzene and one unsaturated ringsystem). They found that benzene was not attacked by 10 % peracetic acid, which statement we can confirm.

By introducing a hydroxyl-group in benzene, the ring becomes much more sensitive towards peracetic acid.

Some preliminary experiments with 10, 20, and 75 % peracetic acid showed that with more diluted solutions the oxidation proceeded regularly :