RÖNTGEN ANALYSIS OF COPPER AMALGAMS.

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Received November 18, 1929. Published January 28, 1930.

In the author's previous paper(1) the following results were published:

(1) The solid phase existing in high mercury amalgams has γ stracture(2) and the lattice dimention is a=9.401Å.

(2) The solid phase prepared by squeezing high mercury amalgams under high pressures has the dimention just described.

(3) The upper copper limit of the homogenity range of the γ phase lies somewhere between 27.1-29.9 weight per cent of copper.

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(1) N. Katoh, *Z. physik Chem.*, [B] **6** (1920), 27.

(2) See Westgren and Phragmen, *Phil. Mag.*, [6] **50** (1925), 311.

(4) High copper amalgams consist in copper and the γ phase at ordinary temperature.

The samples used in the present investigation were prepared at the Minerallogical Institute in Oslo.[1]

For the powder photograms the Cr-K-radiation were used from a tube of the Siegbahn type, which was run with about 45 kilo-volts and 7.5ma. All cameras were designed by Dr. Phragmen.[2] The powder photograms were taken with three cameras of the focussing type, covering whole diffraction range. The cameras were calibrated with sodium chloride. The exposure time varied 5 to 9 hours. All the dimention values based on the length 5.6280Å for the edge of the elementary cube of the sodium chloride.

The photograms were rather weak by want of the practice of handling cameras. The result of the measurement and calculation was shown in the Table 1 and confirmed the former view.

In the case of a good photogram on which every line can be measured accurately, the determination of the lattice dimention may be carried out by means of the most deviated interferences.[3] The figures from each interference agree very well and it needs not farther calculation. But it is reasonable to take all the interferences when the photogram was weak.

The author used three photograms taken by the different cameras for determination of the γ phase. Taking $tg^2\vartheta$ as the weight of the each observation of the interference lines, the constant χ in the equation $\sin^2\vartheta = \chi\ (h^2+k^2+l^2)$ calculated for each photogram by the following formura.[4]

$$\chi=\frac{\Sigma\chi\, tg^2\vartheta}{\Sigma\, tg^2\vartheta}, \qquad \Delta\chi=\pm\sqrt{\frac{\Sigma\left[(\chi-\chi_0)\, tg\,\vartheta\right]^2}{(n-1)\,\Sigma\, tg^2\vartheta}}$$

For the photogram taken by camera 5, $\chi=0.01481\pm0.00001$

,, ,, ,, ,, ,, 6, $\chi=0.01475\pm0.00003$

,, ,, ,, ,, ,, 8, $\chi=0.01478\pm0.00001$

Then the most probable value of the constant was found by taking the weighted mean of the three figures as follows.

$$\chi=0.01479 \qquad (\text{for } Cr-K_\alpha)$$

and the dimention of the γ phase is

(1) N. Katoh, loc. cit.

(2) Westgren and Phragmen, loc. cit.

(3) G. Hägg, Dissertation, 5, 1929 (Uppsala).

(4) E. Broch, *Z. physik. Chem.*, **127** (1927), 452.

$a = 9.399\,\text{Å}$

$a = 9.401\,\text{Å}$ (by Debye cameras)[1]

Tammann[2] observed the existence of the α phase by the thermal analysis but the present author could not find it in the specimens tempered at 100°C. for 48 hours. The powder photograms of a 70.5% Cu amalgam quenched at 380°C, and pure copper tempered at 100°C. taken with the same camera were compared. All the copper lines agree very well, so that the existence of α phase at this temperature is doubtful one but it needs farther investigation to settle this question.

Table 1.

Cr. Radiation. Cu—Hg (24.1% cu).

Intensity	Radiation	$h\,k\,l$	$\mathrm{Sin}^2\frac{\theta}{2}\cdot 10^4$	$((h^2+k^2+l^2)\chi 10^5$
w	β	310	1231	10.1231
s	α	310	1482	10.1482
w	β	321	1722	14.1230
v w	α	322	1777	12.1481
s	α	321	2072	14.1480
m	β	330,411	2246	18.1248
s	α	330,411	2660	18.1478
v·w	β	332	2730	22.1241
v w	α	332	3238	22.1472
w	α	442,600	5336	36.1482
w	β	622	5402	44.1228
m	α	532,611	5616	38.1478
m	$\alpha+\beta$	631	5669	46.1233*
v w	β	444	5870	48.1223
v w	β	543,550,710	6099	50.1220
v·w	α	541	6187	42.1473
m	α	622	6504	44.1478
m	α	631	6787	46.1475
s	α	444	7081	48.1475
m	α	543,550,710	7361	50.1472
w	α		7762	*
s	α_1	552,633,721	7981	54.1478
w	α_2	552,633,721	8010	54.1483
v w	β	811,741,554	8123	66.1231
w	α	642	8326	56.1483
w	α_1	651,732	9126	62.1471
w	α_2	651,732	9160	62.1478

* Extra lines.

(1) W. Katoh, loc. cit.

(2) G. Tammann and Th. Stassfurth, *Z. anorg. Chem.*, **143** (1925), 357.

$Cr\ K\alpha_1 = 2.2848\,\text{Å}$ $\quad \sin^2\vartheta = 0.01479\ (h^2+k^2+l^2)$ for $CrK\alpha$

$Cr\ K\alpha_2 = 2.2890\,\text{Å}$ $\quad a = 9.399\,\text{Å}$

$Cr\ K\beta = 2.0805\,\text{Å}$

$Cr\ K\alpha = 2.2862\,\text{Å}$

Finally, the author desire to thank Professor A. Westgren, Ph.D., whok indly allowed him to carry out this work at the Röntgen Laboratory in the Stockholm Högskola.

October 25, 1929.

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