Transformation from Vitreous to Metallic Selenium

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Abstract

A simple relation was found between the time of annealing and the content of metallic form in the selenium specimen annealed at various temperatures near the transition point.

When vitreous selenium is heated it is changed into metallic form. In a preceding paper[1], this transformation was found by the measurement of its net density[2] to take place mainly between 68°C and 80°C for an annealing time of two hours. Further investigation was made on the relation between the time of annealing and the content of metallic form in the selenium specimen annealed at various temperatures near the transition point. The procedure of determining the weight percentage of metallic selenium contained in the specimen was the same as before. The specimens were annealed for different periods at 65°, 70°, 75° and 80°C. For every specimen the net density was measured and the weight percentage of the content of metallic form was determined.

The results are shown in Figs. 1 and 2, where experimental values are shown by dots and small circles. The time scale in Fig. 1 is five times larger than that in Fig. 2. For a certain temperature of annealing, the content of metallic part increased with the time of annealing till it reached a saturation value. The weight percentage of metallic selenium p in the specimen annealed for t hours at a certain constant temperature can be expressed in exponential form as

$$p = P(1 - e^{-c(t-t')}),$$

where P is the saturation value, c is a constant and t' is a certain time interval chosen to make the above expression fit the experimental data.

P is nearly a constant value of 78.5% for annealing temperatures between 65° and 85°. Further values of P for higher temperatures coincided with those for the time of annealing of 2 hours shown in the preceding paper. The values of c and t' for different temperatures are as is seen in the table. The value of c which determines the rate of increase in weight percent-

	65°	70°	75°	80°
c	0.062	0.089	0.495	1.11
t'	4 h	1.5 h	1.1 h	0.65 h

1. K. Tanaka: These Memoirs, **17**, 59 (1934)
2. U. Yoshida and B. Takei: These Memoirs, **15**, 1 (1932)
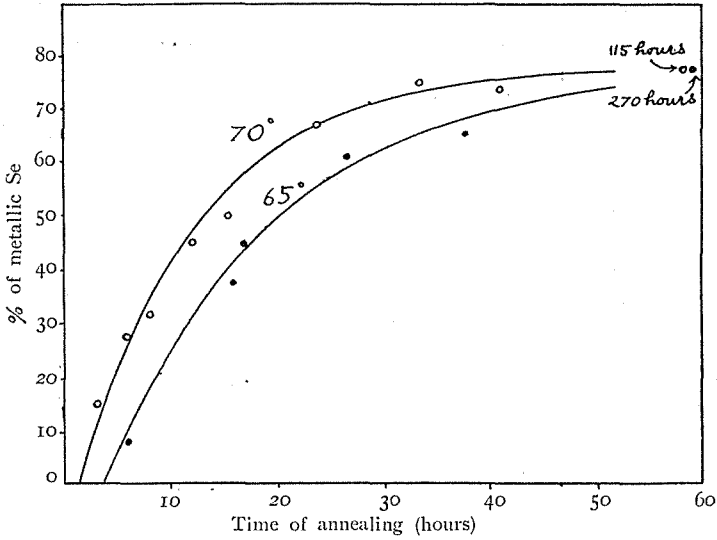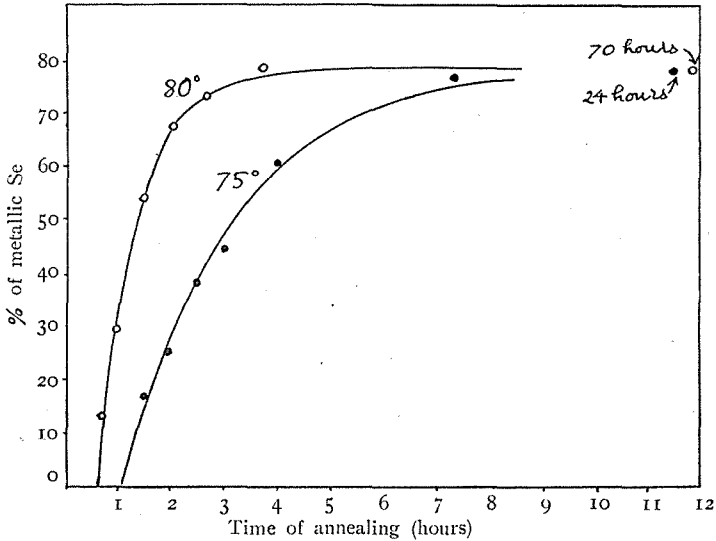
Fig. 1

Fig. 2

age of the metallic part increases rapidly at $75°$ and $80°$. From this it can be said that there is no definite temperature of transition from vitreous to metallic selenium; for though below $70°$ the rate of transition is very small, rapid transition takes place at temperatures higher than $70°$.

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