Effect of Chlorine on the Oxidation of Graphite by Carbon Dioxide

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In the previous papers[1-3] the effects of iodine and bromine on the oxidation of graphite were reported to be an accelerating one. This note reports the experimental results on the effect of chlorine on the oxidation of graphite by carbon dioxide.

Experimental

High purity artificial graphite made from petroleum coke and graphitized at 2400°C was used. The results of a spectroscopic analysis showed that this graphite contained only 0.05 ppm Mg and 0.5 ppm Si as impurities. Impurities other than Mg and Si were not found.

The chlorine gas was fed from a bomb at a constant flow rate and the partial pressure of chlorine was determined by the ratio of the flow rate of chlorine to that of carbon dioxide. The apparatus and the experimental procedures were the same as described in detail in a previous paper.[1]

Results

As shown in Fig. 1, the oxidation rate increased rapidly during an initial period following the supply of chlorine gas into the carbon dioxide gas stream and then gradually decreased to a steady value. This steady value was considered to be that of oxidation rate affected by the presence of

1) T. Mukaibo and S. Yamauchi, *Carbon*, **3**, 87 (1965).
2) S. Yamauchi and T. Mukaibo, *ibid.*, **4**, 455 (1966).
3) S. Yamauchi, T. Mukaibo and M. Hirano, *ibid.*, **5**, 243 (1967).

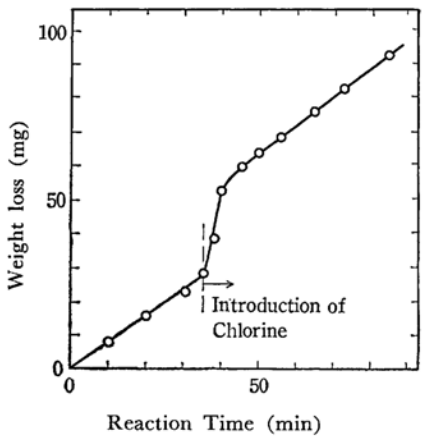

Fig. 1. Weight loss *vs.* time curve (1100°C).

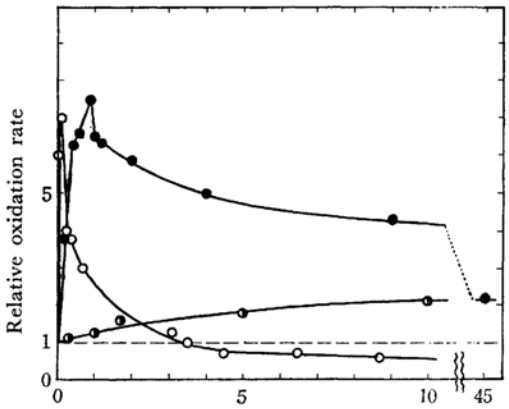

Fig. 2. The dependence of oxidation rates on the partial pressure of halogens.

The relative oxidation rate is defined as a ratio of oxidation rate affected by halogens to that in pure carbon dioxide. If the value of the relative oxidation rate is larger than unity, the effect of halogens is accelerating and if the value is smaller than unity, the effect is inhibiting.

○: chlorine (at 1100°C)
●: bromine (at 1145°C)
◑: iodine (at 1145°C)

chlorine gas.

The oxidation rate was markedly affected by the partial pressures of chlorine gas as shown in Fig. 2. Oxidation rates accelerated by iodine and bromine are also presented in Fig. 2 in order to compare the effect of halogenous gases. It is seen that the oxidation rate has a maximum point at 0.9 Torr in the case of bromine and 0.1 Torr in the case of chlorine, respectively. Any maximum point was not observed in the case of iodine at the partial pressure of 0.3 to 10 Torr.

The most remarkable observation in Fig. 2 is that the effect of chlorine at the partial pressures above 3.5 Torr is an inhibiting one, although an accelerating effect was observed on the effect of iodine and bromine.