§11. Temperature Change and Oxygen Emission Behavior of Copper Oxides during Modulated-Microwave Irradiation

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We study the temperature change and oxygen emission behavior of CuO during modulated-microwave irradiation using high vacuum devices. Details of this device are shown in the previous annual report[1-2]. We measured the temperature, pressures, and partial pressures of outgas. The CuO powder (the purity 99.9%, Kojundo chemical lab., Co., Ltd., Japan) was compacted to the column of 8 mm in the diameter and 2 mm in height. The amount of the sample was about 0.01 mol. The molding supplementary agent has not been added. We use the semiconductor oscillator which can emit modulated microwave (Fig. 1).

Figure 2 shows the results. In this figure, diamond shape (◊) indicates temperature, and open triangle (△) indicates the oxygen partial pressure. At first the frequency of modulation was 50 kHz and the depth of modulation was 40%. At ①, we changed the frequency of modulation from 50 kHz to 100 kHz without changing the depth of modulation. The temperature and the oxygen partial pressure decreased. Then, we changed the depth of modulation from 40% to 20% without changing the frequency of modulation (at ②). The temperature and the oxygen partial pressure were increased. The oxygen partial pressure decreased as increasing the frequency of modulation (at ③: 100 kHz to 200 kHz, at ④: 200 kHz to 400 kHz) but the temperature stayed pretty much the same. The temperature and oxygen partial pressure decreased when the depth of modulation increased from 20% to 40% (at ⑤). Finally, the temperature an d oxygen partial pressure increased after the modulation off (at ⑥).

The obtained data suggest that the temperature and oxygen partial pressure depend on the depth of modulation and the frequency (only between 50 kHz to 100 kHz) of modulation. Furthermore, the data shows the temperature change and oxygen emission behavior during modulated microwave irradiation are different from these during unmodulated microwave irradiation. There is a need for further research to better understand the interaction of microwave and metal oxides.

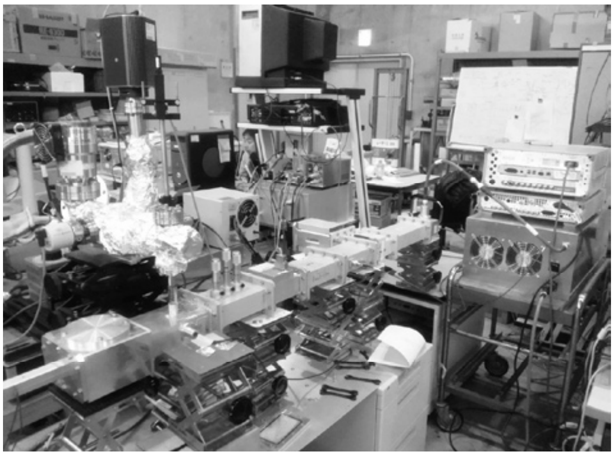

Figure 1. The devices for modulated microwave irradiation.

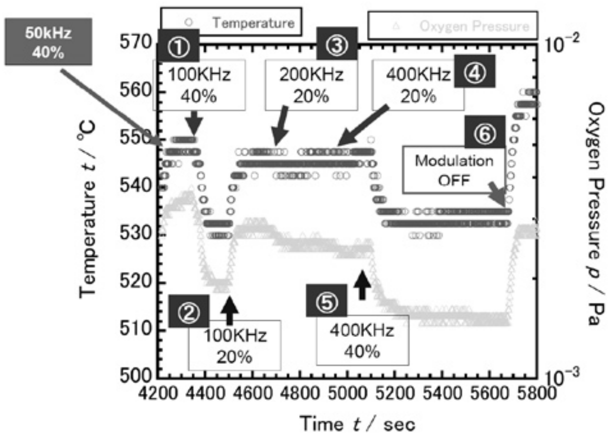

Figure 2. Temperature change and oxygen emission behavior during modulated microwave irradiation.

1) Fukushima J. et al. Annual report of national institute for fusion science (2009), p.420, ISSN 0917-1185
2) Fukushima J. et al. Annual report of national institute for fusion science (2010), p. 438, ISSN 0917-1185.