Highly pure monoclinic beta molybdenum trioxide synthesized by a mini furnace device utilizing a vapor rapid cooling mechanism

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β-MoO_3 is a low temperature phase of MoO_3, which has many applications in electronics, optical devices, gas sensors, semiconductors, and nuclear medicine [1, 2]. From our previous research, β-MoO_3 was synthesized by pulsed wire discharge (PWD) [3]. However, β-MoO_3 synthesized from the PWD method still had some impurity of Mo and α-MoO_3. Therefore, in this report, by utilizing the β-MoO_3 formation mechanism of rapid cooling vapor in PWD, we have made a mini furnace, much smaller than a regular tube furnace, with a higher temperature gradient than that of conventional furnaces. α-MoO_3 powder (99.9% purity) from Nilaco Co., Ltd was evaporated in the mini furnace at different temperatures (T_f) from 750 to 1000 °C under the oxygen gas flow. Samples were collected by micro membrane filters at a position with a temperature of about 60 ºC and were characterized by X-ray diffraction in Fig. 1. From these results, high purity β-MoO_3 powder were obtained at temperatures above 800 °C. Comparing with β-MoO_3 made by PWD, peaks of α-MoO_3 at 27.3º was disappeared. At 750 °C, which is the temperature where MoO_3 starts to evaporate. From temperature distribution results inside the tube in Fig. 2, the temperature gradually decreased from inner to outer of the tube. The temperature gradient increased with the increase in T_f , which might make the purity of β-MoO_3 high at higher T_f.

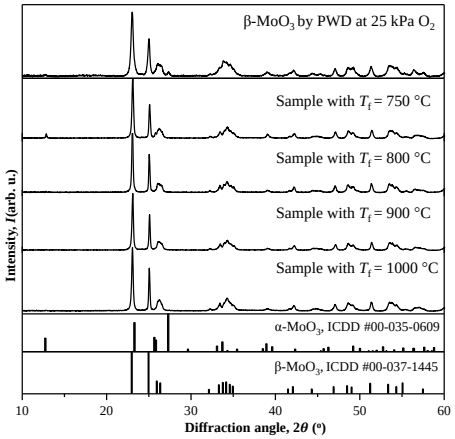

Fig.1. XRD results of β-MoO_3 by PWD, and by mini furnace at different T_f

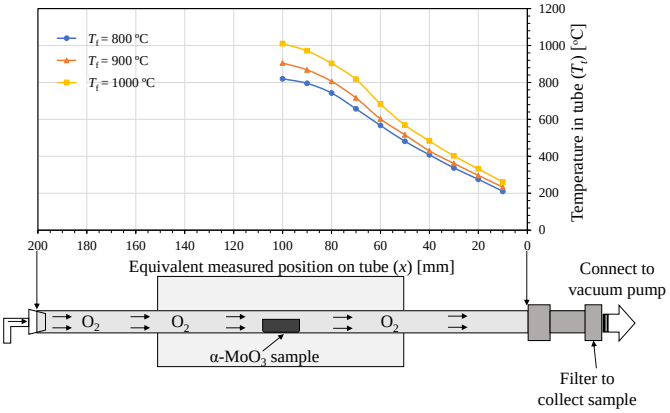

Fig. 2. The temperature distribution inside the tube at different T_f values

From these results, the mass production of β-MoO_3 powders for promising applications can be obtained by utilizing the mini furnace system.

References

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