Measurement of Dew Point Temperature of Pyroprocess Automation Mock-up for Basic Design of Emergency Gas Supply System

Jonghui Han*, Byungsuk Park, and Seungnam Yu

Korea Atomic Energy Research Institute, 111, Daedeok-daero 989beon-gil, Yuseong-gu, Daejeon, Republic of Korea

*jhan@kaeri.re.kr

1. Introduction

An airtight dry room in Pyroprocess automation mock-up was constructed [1]. Currently, a drying system for the room is under construction. For this drying system design, the leak rate and dew point temperature (DP) of the dry room according to purge flow rate of compressed dry air was evaluated [2].

For preventing the equipment in the room from corrosion by salt, the humidity should be controlled at a low level (DP < -40℃). However, the humidity of the dry room can be out of control during blackout, since no compressed air is supplied into the room, and the drying system does not operate at the same time. Hence, in this study, based on the observed moisture trend in the dry room during blackout, a gas supply system is considered as an emergency system.

2. Trend of Moisture Concentration

2.1 DP measurement system

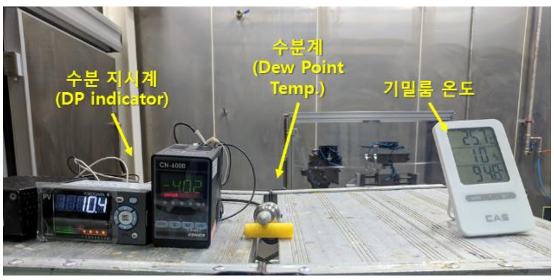

Fig. 1. Moisture measurement system.

As shown in Fig. 1, the moisture and room temperature in the dry room are measured by DP transmitter (DMT-143, VAISALA) and thermometer, respectively. It can be assumed that the measured values are the averaged values in the dry room.

2.2 Measurement of DP trend

The dew point temperature was observed twice in this paper. When no dry air is supplied and the drying system does not work, the DP is expected to be increased even under no pressure difference between the dry room and outer space. It is needed to investigate how DP changes during power outage. Hence, the DP variation was observed two times, one of which was blacked out.

In real blackout, the DP was changed from -36.3℃ to -22.4℃ for 49 hours, or from 122 ppm to 523 ppm when weight basis in air. Hence, the increase rate is about 0.29℃/hour (8.2 ppm/hour).

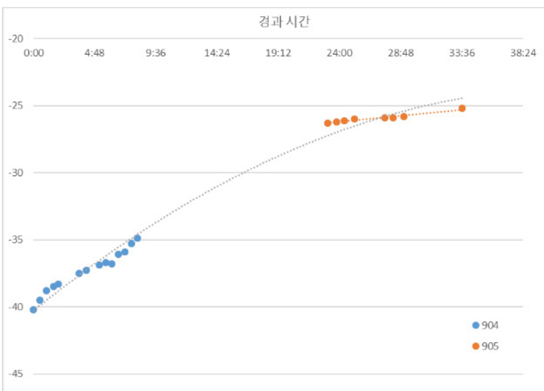

Fig. 2. DP trend in the first measurement.

In second measurement, the blackout was simulated to get detail tendency as time elapsed. Currently, the drying system is not prepared yet, so just the dry air supply was cut for 33 hours. Fig. 2 shows the change of DP, where DP was changed from -40.2℃ to -25.2℃, or from 79 ppm to 390 ppm. The average change rate is about 0.49℃/hour or 9.4 ppm/hour. But the rate of the first 12 hours (-0.54℃/hour) is larger than that of the last 12 hours (-0.09℃). It seems that the increase of moisture gets saturated as time elapsed.

The average rates of two cases are little different. This is because the rate depends on the ambient temperature and moisture level. If the level of estimated final moisture concentration based on this rate is not acceptable, a compensation or assistant system should be prepared to decrease the change rate of DP.

3. Basic Design of Gas Supply System

3.1 Basic Design of Emergency Gas Supply System

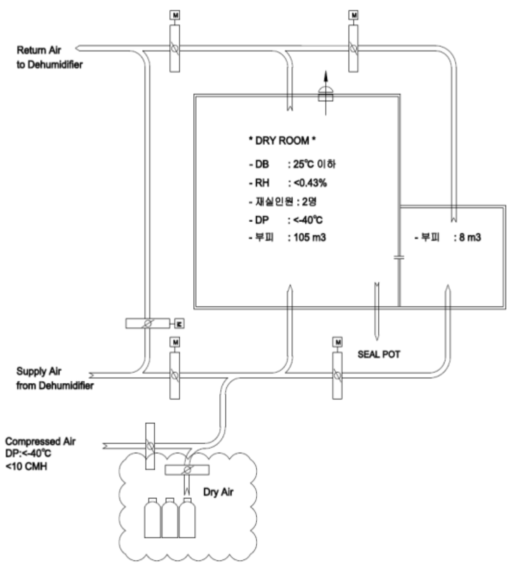

Fig. 3. P&ID of emergency gas supply system.

As shown in Fig. 3, the basic design of an emergency gas supply system will be tied with the supply line of compressed air which will be connected into the supply air duct of the drying system.

The emergency gas supply system is designed as gas cylinders which will supply dry air during power outage. To maintain the DP of the dry room, the flow rate should be 5 CMH at least [2]. Based on this result, the required amount of dry air is about 150 ㎥ for 30 hours, but more experiments will perform to get more accurate capacity.

4. Conclusion

In this paper, to design an emergency gas supply system, the change of DP was observed. Based on these observations, detail design such as gas capacity will be continued.

REFERENCES

[1] J. Han, et al., “Construction of Dry Room for Pyroprocessing Automation Verification Mock-up”, Proc. of the KRS 2018 Spring Conference, May 30-June 27, 2018, Busan.

[2] B. Park, et al., “Preliminary Evaluation of Process Equipment Test Mock-up for Construction of Drying System”, Proc. of the KRS 2016 Spring Conference, 14(1), May 30-June 27, 2016, Mokpo.