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A Gas Analysis of the PRIDE Facility's Argon Tank Interior

Youngkuk Jang [a*], Seonho Noh [a], Ilje Cho [a]
[a]*KAERI, Daedeok-daero 989-111, Yuseong-gu, Deajeon, Republic of Korea 34057*
[*]*Corresponding author: jangyk@kaeri.re.kr*

1. Introduction

Korea Atomic Energy Research Institute(KAERI) has a Pyro-processing Integrated Inactive Demonstration facility(PRIDE) for the development of pyro-technology. In essence, the PRIDE enable integrated pyro-systems testing at engineering scales using depleted uranium or surrogates for depleted nuclear fuels.

The PRIDE must maintain an inactive (argon) atmosphere due to the characteristics of processes that take place in it, such as electrochemical reduction, electrochemical refining, and electrochemical smelting. In concentrating impurities at the facility, oxygen and moisture must be lower than 50 ppm. Changes to argon-cell concentrations are largely due to pressure differences resulting from changes to intracellular temperature and air pressure.

This paper describes the air-tightness of the facility's liquid argon-storage tank, which is in the PRIDE's argon cell, analyzing the gases in the tank.

2. Problem

2.1 The possibility of impurities flowing into the Argon tank. To the maintain an argon-cell environment with moisture and oxygen levels lower than 50 ppm , the argon must be supplied to the tank as a 99.999% pure liquid. Figure 1 shows both a photograph of and a blue print for the argon tank as it presently exists.

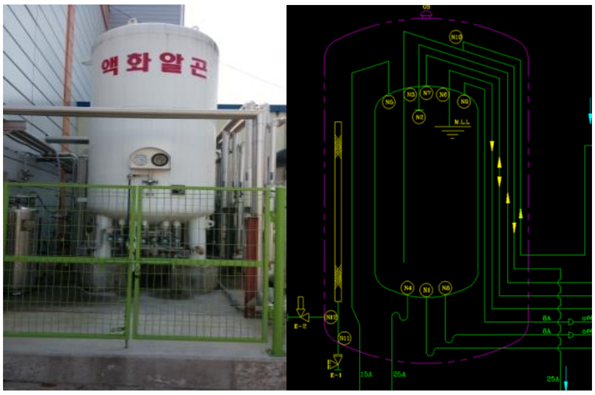

Fig 1. Argon tank

According to the blueprint, the outlet pipe, which supplies the inside of the PRIDE cell, has been installed in the upper part, so when the amount of liquid argon drops below a certain level, impurities can flow into said cell. Figure 2 shows the liquid-outlet line in relation to the argon tank's blueprint.

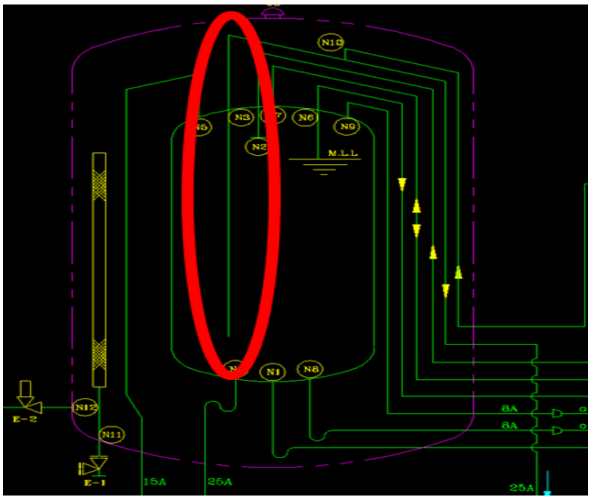

Fig 2. Liquid-outlet line

2.2 A Gas Analysis Using the Pipe in the Upper Part of the Argon Tank.

When the amount of argon within the tank had dropped below 30% of capacity, the V-8 pump collection valve connected to the upper part of the argon tank was utilized in a gas-analysis experiment. Figure 3 shows where the experiment's analyzer was installed.

Fig 3. Oxygen sensor connected to the V-8 valve

2.3 A gas analysis using the argon-tank pipe supplying the evaporator.

To ensure as precise an analysis as possible, a rubber tube was installed at the PSV102 valve, which is connected to the pipe from the argon tank supplying the evaporator. Figure 4 shows the installed analyzer.

Fig 4. Oxygen sensor connected to PSV102 valve

2.4 Results

Table 1. Oxygen level graph of Argon tank

	Time	Oxygen level (ppm)
Argon tank's interior (V-8)	11:30	9
	12:30	0.333
	13:30	0.150
	14:30	0.105
	15:30	0.094

	Time	Oxygen Level (ppm)
Evaporator (PSV 102)	11:00	20.79
	12:00	5.34
	13:00	4.49
	14:00	4.34
	15:00	4.12

3. Conclusions

Both the sensor connected to the upper part of the argon tank and the one connected to the evaporator showed high oxygen levels when they were first installed (11:30, 11:00). Such values are likely the result of the sensors' exposure to air during their initial installations. Otherwise, the other values for both sensors show that the argon tank's upper portion is clean enough to conclude that no impurities exist. Additionally, one might expect conducting the experiment with a stainless-steel tube, rather than a rubber one, would yield more precise values.

REFERENCES

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