Status of the research apparatus for vapor adsorption and desorption using molecular sieve

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1. Introduction

The main purpose of a coolant purification system (CPS), one of ancillary systems in helium cooling fusion reactor, is to prevent the leakage of tritium to outside. The CPS keeps the level of tritium in a helium cooling system (HCS) by extracting tritium from the coolant and transmitting it to tritium accountancy system (TAS) [1]. An ambient molecular sieve bed (AMSB) plays a role in capturing the tritiated water which is oxidized tritium by the oxide bed in CPS. After saturation, AMSB can be regenerated through the pressure temperature swing adsorption (PTSA) process.

In this paper, current status of the test facility for AMSB and the results of ongoing vapor adsorption test and desorption(regeneration) test are presented

2. Test facility and methods

2.1. Test facility: Research Apparatus for Vapor Adsorption and Desorption (RAVAD)

To verify the characteristics of AMSB, RAVAD was established through joint research between KAERI and KFE [2]. The facility is designed to compare vapor absorption and desorption characteristics under various operation condition of vapor concentration and gas flow rate. Figure 1 shows processors or the RAVAD for adsorption test and desorption test. Test conditions are shown in Table 1

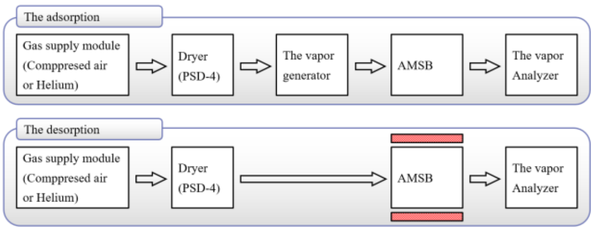

Fig. 1. Procedure of the AMSB apparatus for adsorption and desorption

Table 1. Test condition of RAVAD

Parameter	Value
System pressure	0.33 MPa
Temperature	25 ℃ (adsorption) 300 ℃ (desorption)
Vapor concentration	33 Pa
Superficial velocity	0.05 - 0.3 m/s

In the test section, various AMSBs with different diameters and lengths can be applied to verify the geometry effects. Eight AMSBs were manufactured with different geometry, and their dimensions are presented in Table 2. Several tests were conducted to verify the effects of the column length and diameter. Changes in the vapor concentration at the outlet of AMSB are observed, and the time until break-through point at which the ratio of the effluent is maintained below 1% is measured through the tests.

Table 2. Geometry of the AMSBs

AMSB module		Length[mm]			
		24	44	64	84
Diameter [mm]	16	#1	#7	#4	
	20	#2		#5	
	24	#3	#8	#6	#9

3. Conclusion and further works

To verify the performance of AMSB, RAVAD was built, adsorption and desorption scenarios were performed under various operating conditions, and a database was established. The diameter effect and length effect could be confirmed by comparing the results, revealing that the adsorption time is different depending on the operating conditions and the type of AMSB. These results are being analyzed through predictive models, and the analysis results will be used for code analysis and design optimization. In the future, the test will be carried out by changing the working gas.

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