INTERMETAL COMPOUNDS FOR DEEP PURIFICATION OF HYDROGEN ISOTOPES FOR MUON CATALYZED FUSION EXPERIMENTS

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The method of cleaning hydrogen isotopes of gaseous admixtures with hydrides of metals has perspective in muon catalyzed fusion, along with the method of diffusion through palladium alloys. They both are highly selective, deep cleaning and easy [1].

The applicability of hydride-producing intermetal compounds (IMC) for cleaning hydrogen isotopes depends on their sorbing, equilibrating and kinetic properties. We have investigated the following species of intermetal compounds [2] from this point of view: $Zr_{0.7}Ti_{0.3}Mn_2$ and $Zr_{1-x}Ti_xCoNi$. In fig. we show the isotermic diagrams of sorbtion and desorbtion of hydrogen by these compounds, they relate the values of pressure, concentration and temperature.

There is an isobaric region on the diagram which corresponds to formation of hydrides. The systems ($Zr_{0.7}Ti_{0.3}Mn_2 + H_2$) and ($Zr_{1-x}Ti_xCoNi + H_2$) have the equilibrium pressures of dissociation 4 torr and $3 \cdot 10^{-2}$ *torr*, respectively, in the flat region at 293 *K*. The widths of the corresponding two-phase regions are about 100—120 cm^3 (H_2)/g (of compound).

These compound-plus-hydrogen systems demonstrate a kind of hysteresis behaviour: the pressure of hydride formation is higher than the pressure of hydride dissociation. Their equilibrium and kinetic properties prove their applicability for cleaning and gasfilling purposes in nuclear fusion installations.

We have investigated the cleaning process of hydrogen contaminated by an inert gas. The cleaning was done in 3 stages: first, sorbing the hydrogen of the gas mixture by the IMC-containing reactor; second, pumping the reactor to eliminate the admixture; third, desorbtion of hydrogen from the compound.

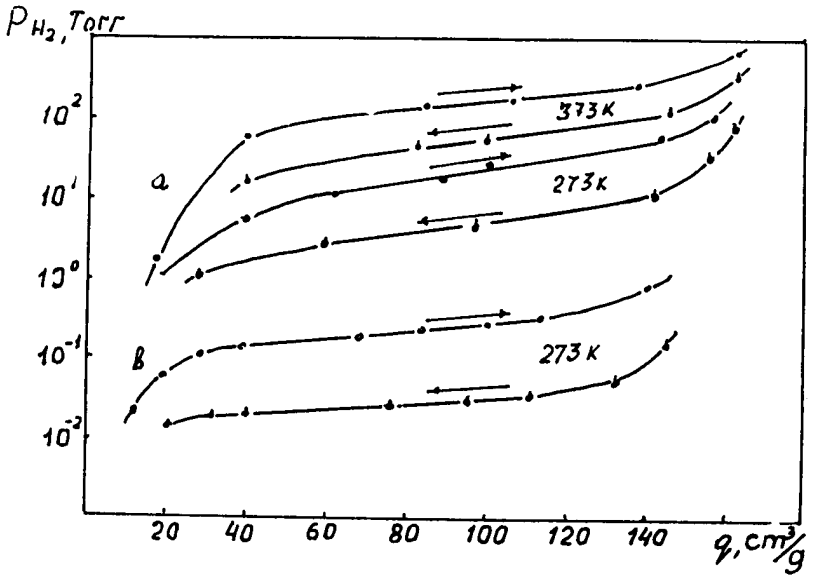

Fig.

Table demonstrates the dependence of Argon concentration in the purified gas on pumping conditions of the reactor during the cleaning experiment. The initial concentration of Argon was 3%. The cleaning proves to be effective and fast. This data is to be used in a design of a new cleaning unit for MCF experiments.

Table

Dependence of hydrogen purity vs.pumping conditions

Pumping:		Admixture concentration, % of volume
T.K	time, *s*	
293	10	$2 \cdot 10^{-3}$
	30	$8.5 \cdot 10^{-4}$
	120	$3 \cdot 10^{-4}$
241	120	$2.5 \cdot 10^{-4}$
	300	$1.5 \cdot 10^{-4}$

References

1. Perevesentsev A.N. et al. Preprint LNPI-1730. Leningrad. 1991. 11 p.
2. Perevesentsev A.N. et al. //Phys.Elem.Particles and Nuclei. 19. 1988. 1386.