STUDY OF HYDRODGEN ISOTOPE ADSORPTION BY SYNTHETIC ZEOLITES IN EXTENDED TEMPERATURE RANGE

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There is considerable interest in the study of Hydrogen Isotope Adsorption through the development and application of this method for the separation of tritium-contained mixtures. For instance, in the fusion teechnology context Hydrogen Isotope Adsorption can be used principally to regenerate nuclear fuel and to facilitate the transportation of those mixtures /1/.

In our previous papers /2—7/ we investigated the isotopic and phase equilibria and the kinetics of an interphase hydrogen isotopic exchange by NaX,NaA,CaET-4B zeolite sorption in the 77—87 K temperature range and pressures 10^{-8}—3.0 MPa. Developing these works we have constructed a special unit which has allowed to fulfil experiments in the 20—200 K temperature range. The accuracy of the thermal stabilization was ± 0.3 K.

The bynary equilibrium constants of H_2—HT and D_2—DT molecule separation were measured for the process of sorption by NaA zeolite in the temperature range of 22 to 140 K. The results of these measurements are shown in table. The separation factor of the hydrogen molecules was many times higher for the process of NaA zeolite sorption than in the case of rectification at the same temperature.

Hydrogen isotope interphase exchange kinetics has been studied in the process of hydrogen sorption by NaX and NaA zeolites in the 38—96 K temperature range. This was done by methods that had been described earlier /6,7/. The value HETP linearly rose with loading at every fixed temperature and rose when the temperature was decreased.

Our experimental data having been obtained for a wide temperature range allows to optimize the adsorption separation process.

Table

Separation factors of H_2—HT and D_2—DT molecules for sorption by NaA zeolite for various temperatures

H_2—HT		D_2—DT	
Temperature, K	Separation factor	Temperature, K	Separation factor
96 ±0.5	1.57±0.06	137 ±2	1.12±0.06
87 ±0.5	1.78±0.06	99 ±1	1.17±0.05
86.5±0.15	1.71±0.06	87.5 ±0.3	1.23±0.04
79.0±0.5	1.80±0.05	83.1 ±0.3	1.24±0.05
77.6±0.3	1.84±0.06	77.6 ±0.3	1.29±0.04
75.0±0.5	1.95±0.1	64.0 ±0.3	1.48±0.06
64.5±0.5	2.5 ±0.1	53.3 ±0.1	1.70±0.03
60.9±0.3	2.6 ±0.1	50.9 ±0.5	1.76±0.03
55.0±0.5	3.3 ±0.1	45.2 ±0.5	1.96±0.06
51.0+0.5	3.9 ±0.2	33.3 ±0.3	2.70±0.08
45.0±0.5	5.8 ±0.2	25.25±0.3	4.3 ±0.1
31.9±0.3	17.8 ±0.8		
28.0±0.6	29.7 ±1		
27.5±0.6	34 ±1		
22.5±0.2	69 ±7		

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