

TEMPERATURE DEPENDENCES OF DYNAMIC  
PARAMETERS OF WATER IN FOSSIL-COAL  
PORES

*A.D. Alexeev, T.A. Vasilenko, A.K. Kirillov,  
O.M. Molchanov, G.A. Troitsky*

Institute for Physics of Mining Processes,  
Nat. Acad. of Sci. of Ukraine  
(72, R. Luxemburg Str., Donetsk 83114, Ukraine;  
e-mail: *tvasilenko@mail.ru*)

S u m m a r y

The results of nuclear magnetic resonance (NMR) studies of water relaxation times,  $T_1$  and  $T_2$ , and self-diffusion coefficients,  $D$ , in water-saturated pores of fossil coal (anthracite A) are reported. The spin-echo and broad-line NMR measurement techniques were used. The resonance frequency of  $^1\text{H}$  spins was found to equal  $f \approx 20$  MHz in the temperature,  $T$ , range from 90 K to room temperature. The results of experiments evidence the existence of a smeared phase transition in the temperature range  $T = 180 \div 230$  K. Using the Uo–Fedin technique, the corresponding phase transition energy was estimated to be  $U_0 = 27 \div 35$  kJ/mol. The activation energy  $E_a$  associated with the  $T_2(T)$  dependence was found to increase from 4 kJ/mol at  $T = 90$  K to 18 kJ/mol at  $T = 300$  K. The deviation of the temperature dependence of the self-diffusion coefficient  $D$  from the Arrhenius law was explained by the change-over from the bulk diffusion mode to the surface one as the temperature decreased.