INVESTIGATION OF NUCLEAR SPIN CONVERSION OF METHANE IN SOLID HYDROGEN

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We have studied nuclear spin conversion of CH_4 and CD_4 trapped in solid H_2 and solid D_2 by Fourier-transform infrared spectroscopy. It has been shown that the rotational quantum number J of methane is still a good quantum number in solid hydrogen. The effective rotational constant has been found to be about 90 % of the gas phase value. The vibration-rotation absorption of both CH_4 and CD_4 exhibited time-dependent intensity changes at liquid He temperatures. These changes are interpreted to be a result of the $I = 1 \rightarrow I = 2$ nuclear spin conversion which accompanies the $J = 1 \rightarrow J = 0$ rotational relaxation. The conversion rate is on the order of 10^{-3} min^{-1}, but the rate depends on the temperature of the crystal. Mechanisms of the nuclear spin conversion in solid hydrogen will be discussed.