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IR Studies of Thermally Stimulated Structural Phase Transformations in Cryovacuum Condensates of Freon 134a

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ABSTRACT

The method of cryovacuum condensation of thin gas films and, in particular, condensation involving the formation of glassy states, provides ample opportunities for precise control and maintenance of the formation conditions of studied samples. This has prompted researchers to formulate and address the question of the relationship between the formation conditions/structure of molecules and the degree of kinetic stability of cryocondensates, including organic glasses. This study focused on thin films of Freon 134a cryovacuum condensates condensed on a cooled metal substrate comprised of gas at deposition temperatures ranging from 16–100 K and gas phase pressures from 10^{-4} to 10^{-6} Torr. A comparison between the vibrational spectra of Freon 134a in the gas phase and in the cryocondensed state is provided. The results of IR spectrometric studies of cryovacuum condensates of Freon 134a (2.5 μm thick) in the frequency range 400–4200 cm^{-1} are presented. Based on the obtained spectra and data on their thermally stimulated transformations, an assumption is made that, in the temperature range 16–60 K, Freon 134a cryocondensates are in an amorphous state with different degrees of amorphization. At the vitrification temperature of 70 K, transition from the amorphous glassy state to the state of the supercooled liquid phase takes place, followed by its crystallization into the state of a plastic crystal. In the temperature range of 78–80 K, the transition of a plastic crystal to a crystalline state with a monoclinic lattice begins.