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Determination of the isotopic composition of aqueous solutions radio-spectroscopic method

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The proposed new method is based on the spectra of radio wave radiation of the microwave range wideband scanning receiver. It is experimentally proved that this method has a high accuracy in the determination of the frequency spectrum. This allows reaching a sensitivity of 5-6 Hz/nm. The obtained spectra are analyzed for the particular program hardware-software complex. Practice has shown that the proposed method allows not only to detect the difference of the substances qualitative composition and concentration, but also to determine the presence of heavy and super heavy hydrogen isotopes in water. The method for determining the presence of substances in nanoscopic amount is based on the registration of radio-wave emission spectra in the microwave region using a scanning wideband receiver. This radiation arises owing to the excitation of alternate high-frequency displacement and conduction currents in an object subjected to testing between the flexible plates of a capacitive working sensor. The results from measurements (the obtained spectra) are analyzed using a hardware-software complex. For the research of aqueous solutions it is important to establish how the structure of water is influenced by temperature. In Fig. 1 shows the changes in the spectra of water temperature. The spectral pattern changes when the water is frozen to ice (spectra 2). Additional peaks emerge in the right side of the spectrum, beginning at a frequency of 2456.54 MHz. After the water returns to the liquid state (spectra 3) at the reference temperature (25°C), the spectra differ from the initial one by shifting toward an increase in the frequency of the spectra and a drop in the amplitudes of all peaks. Finally, it is concluded that: The method of radioscopy in the microwave range allows us to explore the fluid system, by comparing the spectra of the pure solvent (reference samples) and solutions; in this work, the parameters of the spectra of the standard with bi-distilled water and aqueous solutions: individual substances in the analyzed water; the difference of the concentrations of dissolved substances; evaluation of isotopic composition in the system of hydrogen isotopes and; it was established experimentally that this method can detect the presence of small quantities of heavy (D) and super heavy (T) hydrogen isotopes in ordinary (H₂O) and heavy (D₂O) water.

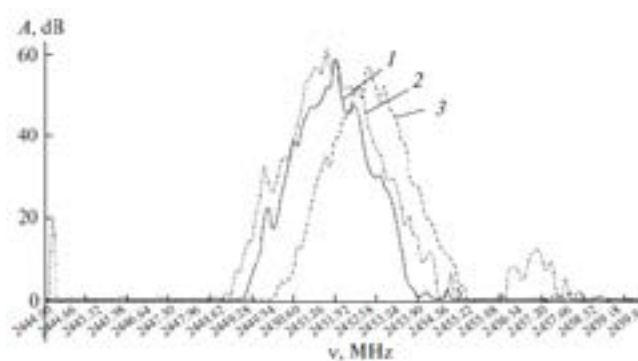


Fig. 1 Spectra of water in different states: (1) initial state at 299 K, (2) frozen state at 273 K, (3) thawed state at 299 K.

Biography

Rostislav Gerasimov has his expertise in radioscopy of liquids, solids and nondestructive control of construction materials. His universal non-destructive testing method in microwave range is based on comparing the research object to the reference pattern.

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