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Reconstruction of spontaneous electric current attractors in oxyhydrides of *d*-elements and phonon (or electro-acoustic) echo in colloidal systems

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Abstract

The oxyhydrates of most *d*- and *f*-elements show pronounced ferroelectric properties, which are manifested in the appearance of a spontaneous nano-electric electric current in a colloidal-chemical cell.

The fluctuations in the amplitude of the measured current can vary from 5-10 nA to 0.5 μA, and the amplitude of the current does not depend on the duration of the experiment. In this case, one-time strong current bursts can occur, reaching values of 0.2 μA at a background level of 5 nA. At the same time, it is visually difficult to distinguish the current dependencies for oxyhydrates of various elements of iron, tin, zirconium, yttrium, and so on. The time interval between pulses is 51.2 seconds.

The electroacoustic effect in systems of the type of oxyhydrate of *d*-elements is found to be evidence of the regular formation of giant polyhedral structures involving water in gel systems. These designs live in time, change. Structures of tin oxyhydrate that vary with time are shown. We can talk about the phenomenon of electro-acoustic echo (or the so-called phonon echo) in unusual gel colloid systems. This phenomenon consists in the revival of the coherence of acoustic oscillations at certain times after the application of several pulses of an alternating electric field (which arise spontaneously) to the colloidal piezoelectric (oxyhydrate gel) in the case of oxyhydrate colloids.

As a result of the nonlinear interaction of a packet of sound waves with frequency w with the electric field of a second pulse with frequency ω or 2ω, a new, reversed sound packet with a frequency equal to the frequency of the original packet is generated and propagates in the opposite direction, that is, so-called reversed waves are produced. This new package revives the coherence of oscillations and the growth of the amplitude of the reversed packet. The amplitude of the reversed packet becomes maximum, which is experimentally established.

Long-term memory, which lasts much longer than the sound vibrations excited by pulses, is associated with the emergence (as a result of the interaction of a pair of electrical impulses with a water cluster) of some stationary state that remains after the attenuation of sound oscillations and carries information about the amplitudes in the phases of creation of its pulses. This steady state is regarded as an acoustic hologram obtained experimentally.

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