ELECTRIC CHARGE ACCUMULATION AT THE INTERFACE OF SUPRAMOLECULAR CLATHRATE MCM-41<CH_4N_2S<$CoCl_2$>>

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One of the biggest challenges for humanity today is the task of developing efficient technologies for accumulating and storing electricity. The electrochemical systems in use, which are divided into lithium-ion batteries and carbon supercapacitors, are unable to meet the rapid growth in energy consumption despite constant improvement and increase in their efficiency. Their main disadvantages are insufficient energy capacity, inability to be miniaturized and incorporated into microelectronics, and harmful environmental impact. Therefore, fundamental research in this area has become extremely relevant, which will allow us to offer a radically new approach to solving the problem of electricity storage. All studies are actually related to the development of the concept of quantum energy storage as an alternative to existing electrochemical ones.

Methods of investigation:

- ***Impedance spectroscopy***
- ***Thermostimulated discharge methods***

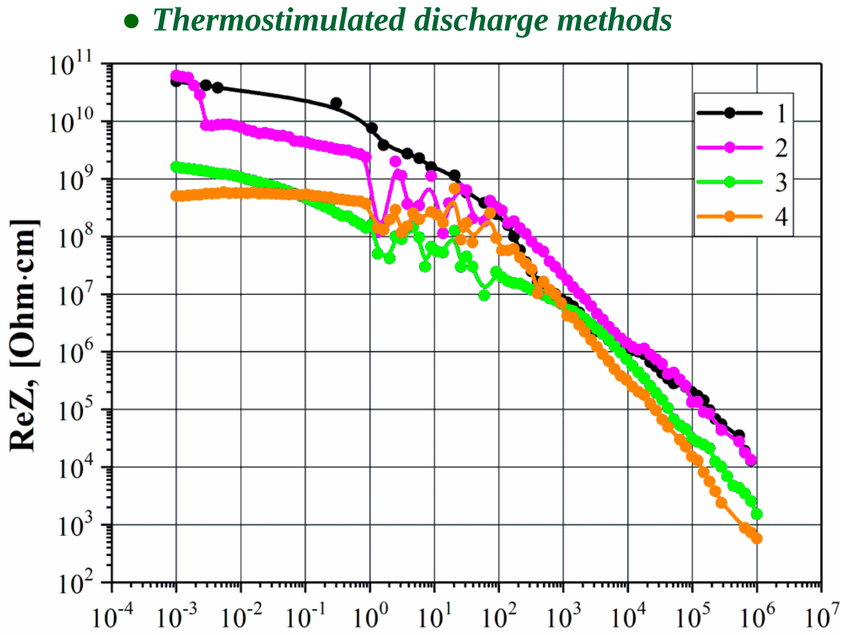

Figure 1. Frequency dependencies of the real term of the clathrate MCM-41<CH_4N_2S <$CoCl_2$>> specific impedance, measured under normal conditions (2), in magnetic field (3) and under illumination (4). (1)- matrix MCM-41.

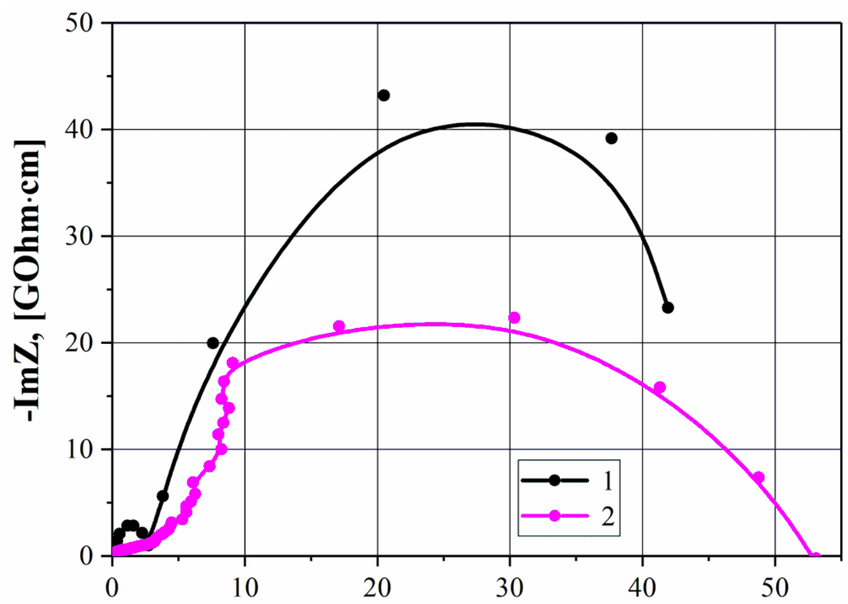

Figure 2. Nyquist`s diagrams of clathrate MCM-41<CH_4N_2S <$CoCl_2$>>, measured under normal conditions (2), in magnetic field (3) and under illumination (4). (1)- matrix MCM-41.

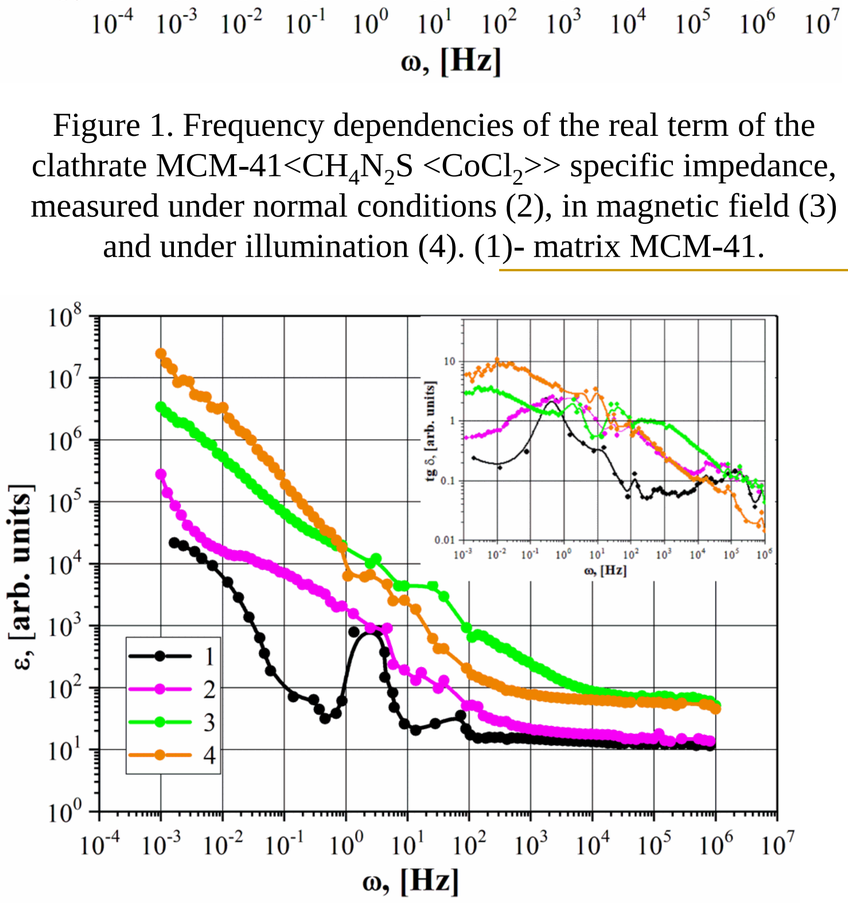

Figure 3. Frequency dependencies of the dielectric constant of the MCM-41 (1) and the clathrate MCM-41<CH_4N_2S <$CoCl_2$>> , measured under normal conditions (2), in magnetic field (3). In the inset – the dielectric loss tangent of the clathrate MCM-41<CH_4N_2S <$CoCl_2$>>.

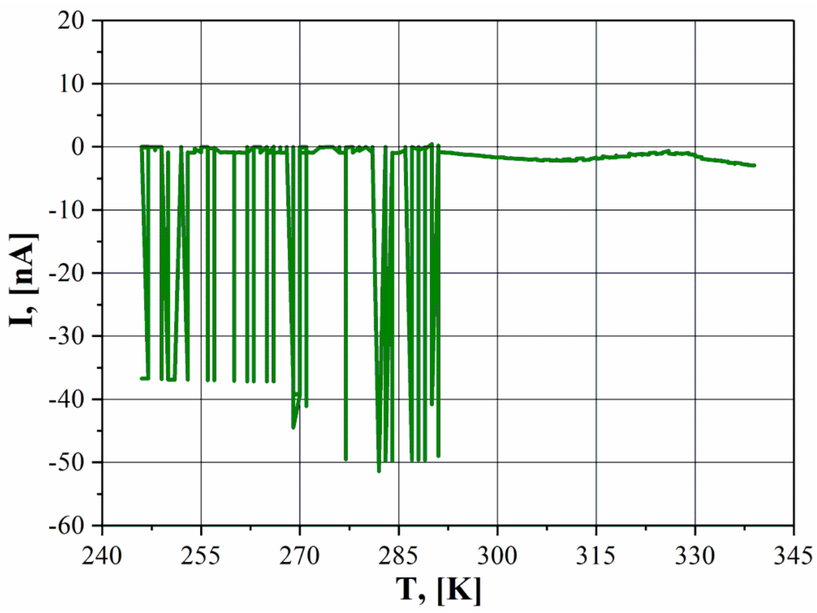

Figure 4. Spectra of thermostimulated discharge for clathrate MCM-41<CH_4N_2S <$CoCl_2$>> .

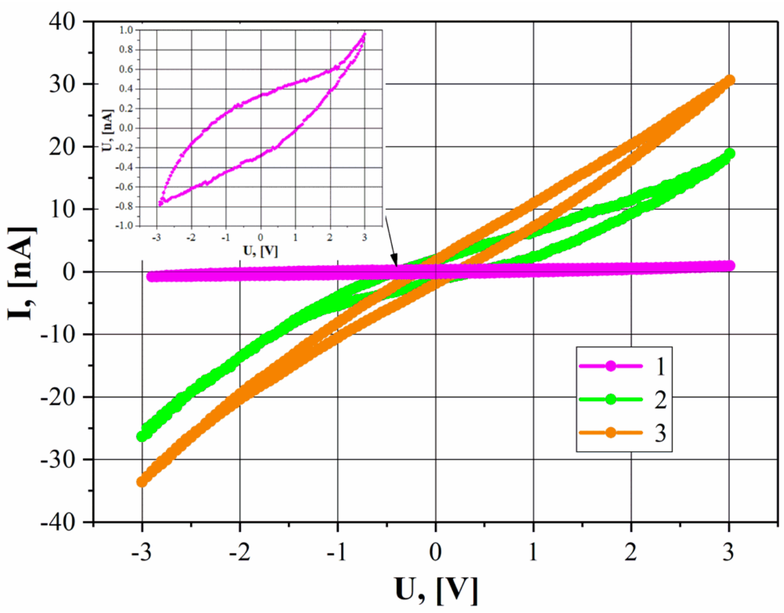

Figure 5. Volt-ampere characteristics of clathrate MCM-41<CH_4N_2S <$CoCl_2$>> , measured under normal conditions (1), in magnetic field (2) and under illumination (3).

CONCLUSIONS

1. **For the MCM-41<CH_4N_2S<$CoCl_2$>> clathrate, photoresistive and magnetoresistive effects were recorded. The latter can be of considerable practical importance for the manufacture of ultrasensitive readout heads in magnetic storage devices.**
2. **Homocharge relaxation occurs in the encapsulated MCM-41<CH_4N_2S<$CoCl_2$>> in the entire investigated temperature range. At the same time, the spectrum of the thermally stimulated discharge at low temperatures acquires a narrow-banded miniband appearance with a high density of states, which at room temperatures transitions to practically continuous sets of relaxation times.**
3. **The volt-ampere characteristics of the obtained clathrate MCM-41<CH_4N_2S<$CoCl_2$>> has a hysteresis appearance, which indicates its ability to accumulate electrical energy at the intergranular boundaries.**
4. **The polarization measurements of the MCM-41<CH_4N_2S<$CoCl_2$>> clathrate have recorded a high dielectric constant of $2.8*10^5$ in the low-frequency range, which indicates the prospects of using this structure as a material for the manufacture of a quantum battery.**