COINTERCALANT CLATHRATE OF GaSe<<$NaNO_2$>+<$FeCl_3$>> CONFIGURATION AND ITS PROPERTIES

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The formation of functional materials at the level of nanoscale objects is a powerful tool for creating functional hybrid systems with unique properties and behaviour. The issue of dimensional effects in the field of ferroelectric polarization and nanomagnetism is gaining considerable interest among scientists nowadays.

In this context, we investigated a clathrate structure formed on the basis of the layered semiconductor host-matrix GaSe by sequential cointrecalation of ferromagnetic $NaNO_2$ and ferromagnetic $FeCl_3$ guests. By this method, a GaSe<<$NaNO_2$>+<$FeCl_3$>> clathrate structure was formed.

Methods of investigation:

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

Figure 1. The formed sample of GaSe<<$NaNO_2$>+<$FeCl_3$>> clathrate.

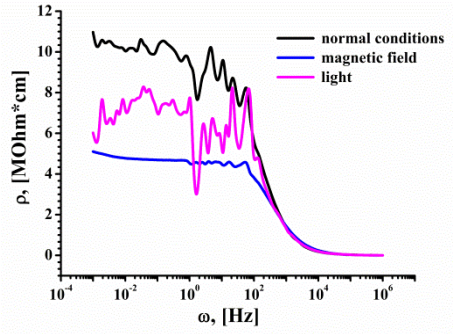

Figure 2. Frequency dependencies of the real term of the GaSe<<$NaNO_2$>+<$FeCl_3$>> specific impedance, measured under normal conditions, in magnetic field and under illumination.

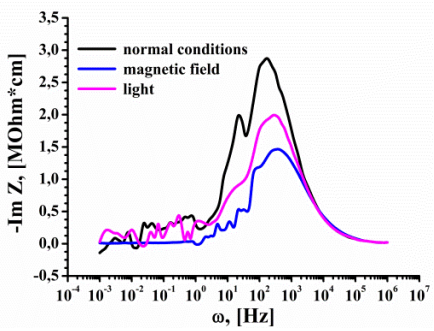

Figure 3. Frequency dependencies of the imaginary term of the GaSe<<$NaNO_2$>+<$FeCl_3$>> specific impedance, measured under normal conditions, in magnetic field and under illumination.

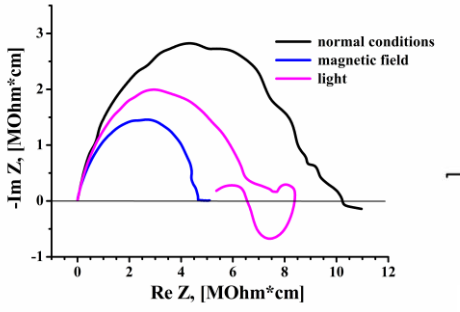

Figure 4. Nyquist`s diagrams of GaSe<<$NaNO_2$>+<$FeCl_3$>> , measured under normal conditions, in the magnetic field and under illumination.

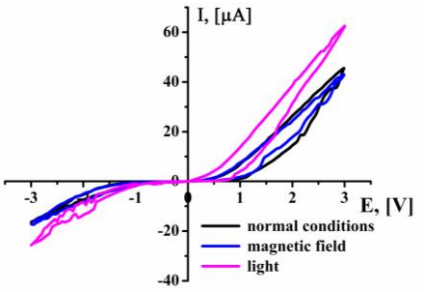

Figure 5. Volt ampere characteristics of GaSe<<$NaNO_2$>+<$FeCl_3$>> , measured under normal conditions, in the magnetic field and under illumination.

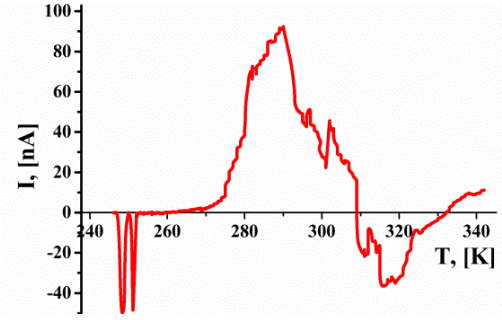

Figure 6. Specter of thermostimulated discharge GaSe<<$NaNO_2$>+<$FeCl_3$>> .

CONCLUSIONS

1. **For the first time, the GaSe<<$NaNO_2$>+<$FeCl_3$>> clathrate with a coiintercalation guest component was formed using the intercalation technology.**
2. **In the cointercalant clathrate GaSe<<$NaNO_2$>+<$FeCl_3$>> recorded a negative magnetoresistive effect of 50%, a positive magnetocapacious effect of 90% and inductance, the value of which can be controlled by illumination.**
3. **The extraordinary behavior of volt-ampere characteristic was observed and it appears as a pronounced hysteresis, which indicates the accumulation of electric charge at the interphases in synthesised clathrate GaSe<<$NaNO_2$>+<$FeCl_3$>>. This result opens the possibility of creating quantum analogues of electrochemical autonomous sources of electrical energy.**