

Results from research project – stage ...

Contract No: КП-06-Н64/4 от 15.12.2022
Initial and final date of the project: 15.12.2022 – 15.12.2025
Project title: Hydrates and complexes of magnesium salts, sulphates, chlorides, chlorates-synthesis, structure, properties. Behaviour in simulated environments and relation to ecology.
Research organization: Institute of mineralogy and crystallography „Acad. Ivan Kostov” – BAS
Principle investigator:
Prof. Dr. Rosica Petrova Nikolova

Publication from the project
For each publication, please, provide:
<ul style="list-style-type: none"> – Bibliographic information (<i>for journals with IF, please, provide the IF of the journal in the year of publication</i>) – Internet link to the publication in the electronic version of the journal and/or link to publically accessible electronic version of the publication
Nikolova, R., Kostov-Kytin, V., Petrova, N., Kossev, K., Titorenkova, R., & Velyanova, G. (2024). New Data on Crystal Phases in the System $MgSO_4-OC(NH_2)_2-H_2O$. <i>Crystals</i> , 14(3), 227. IF: 2.670; кuartил: Q2 Линк: https://doi.org/10.3390/cryst14030227
Nikolova, R., Kostov-Kytin, V., Petrov, P., Tsvetanova, L., Gospodinov, N., & Metodieva, K. (2023). Sulphate mineralization from one locality in Lozen ore field, Eastern Rhodopes. Review of the Bulgarian Geological Society, 84(3). IF: 0.2; кuartил: Q4 by citation indicator Линк: https://bgd.bg/review-bgs/година-84-2023-книга-3/
Velyanova, G. G., & Kossev, K. S. (2023) Environmentally acceptable synthesis of magnesium bearing fertilizers. 2. Mechanochemical preparation. <i>Bul. Chem. Comm.</i> , Volume 55, Special Issue C (pp. 33–36). IF: 0.349; кuartил: Q4 Линк: https://doi.org/10.34049/bcc.55.C.0003
Kossev, K., Velyanova, G., & Nikolova, R. „Environmentally acceptable synthesis of magnesium bearing fertilizers“. Proceedings of University of Ruse - 2023, vol. 62, book 10.1. Линк: https://conf.uni-ruse.bg/bg/?cmd=dPage&pid=sns-proc23

Main results from the research project

During the first eighteen months of the project implementation, following the work programme, the planned low temperature measurement attachment, workstation and computer system were purchased, the necessary reagents and laboratory consumables were provided, and studies were carried out to specify the phases in the triple systems $MgSO_4 (Cl_2, ClO_3, ClO_4) - nOC(NH_2)_2 - mH_2O$; methodologies for the preparation of urea-containing phases by crystallization from water and by mechanochemical activation were defined; the structural, thermal and spectral characteristics of the new phases were investigated; and phase change studies of hydrates of magnesium salts were conducted. In the text below, urea ($OC(NH_2)_2$) will be noted with "Urea" for clarity.

For the $MgSO_4 - nUrea - mH_2O$ system, phase diagrams have been prepared, the preparation of four compounds of the $MgSO_4 \cdot nUrea \cdot mH_2O$ type has been confirmed, conditions for their preparation in pure form and conditions for the preparation of single crystal samples have been specified, their thermal and spectral characteristics have been described, and for two of them their crystal structures have been solved for the first time (<https://doi.org/10.3390/cryst14030227>). A product has been defined that shows properties suitable for use in agrochemistry and can be obtained in an environmentally friendly manner (<https://doi.org/10.34049/bcc.55.C.0003>). The phase transformations of a system of natural magnesium sulphates under hydration and dehydration were investigated (<https://doi.org/10.52215/rev.bgs.2023.84.3.47>). For the $MgCl_2 - nUrea - mH_2O$ system, a phase diagram has been prepared, the preparation of four compounds of the $MgCl_2 \cdot nUrea \cdot mH_2O$ type has been confirmed, conditions for their preparation in pure form and conditions for the preparation of single crystal samples have been specified, and for two of them their crystal structures have been solved for the first time. In the $Mg(ClO_4)_2 - nUrea - mH_2O$ system, only two polymorphic modifications of $Mg(ClO_4)_2 \cdot 6Urea$ were obtained, for which crystal structures were determined for the first time, and in the $Mg(ClO_3)_2 - nUrea - mH_2O$ system no new compounds were obtained

The implementation of the project activities provided an opportunity for one post-doctoral fellow and two students to learn methods for synthesis by evaporation and tribochemical activation, to use analytical equipment for physicochemical characterization of natural and synthetic inorganic materials, to gain experience in formulating and performing scientific tasks, and to interpret and publish results. The project and the obtained results have been presented at three scientific forums in the country and one outside the country.

With the implementation of the work programme, the main objectives of the of the project, namely to increase the knowledge of crystal hydrates and complexes of the most the most common naturally occurring magnesium salts with data on the behaviour of these compounds in conditions different from those at the Earth's surface. A team of young scientists has been established to continue one of the traditional themes of the IMC.