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Editorial

Mineralogical Crystallography Volume II

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The International Mineralogical Association and UNESCO celebrates 2022—the Year of Mineralogy. However, this year was not chosen randomly. Indeed, 2022 is the bicentennial of the death of René Just Haüy (born 1743), who is considered to be one of the founders of crystallography and mineralogy in their modern state. The year 1822 also marks the publication of Haüy's *Traité de minéralogy* and *Traité de cristallographie*. Mineralogy is one of the oldest branches of science, with its origin in at least antic times, but its scientific renaissance started a little more than a century ago, when precise crystallographic studies, such as X-ray structural analysis (mainly, but not only), significantly improved the value of research results. Since the first decade of the XX century, mineralogy and crystallography together have played a key role in our everyday lives.

Various scientific events are being held around the world under the auspices of this landmark event, the Year of Mineralogy, and it is highly satisfying that this Special Issue "Mineralogical Crystallography Volume II" is published in 2022. The first volume of the "Mineralogical Crystallography" Special Issue [1] consisted of such topics as: Discovery of new mineral species; Crystal chemistry of minerals and their synthetic analogs; Behavior of minerals at non-ambient conditions; Biomineralogy; and Crystal growth techniques, and appeared to be very fruitful. The Special Issue "Mineralogical Crystallography Volume II" covers the following topics: Crystal chemistry and properties of minerals and their synthetic analogs; Gemology; Natural-based cement materials; Biomineralogy; and Crystal growth techniques. Additionally, we hope that this continuation will be just as successful, and that the new set of papers will again arouse genuine interest among readers and, perhaps, inspire them in their own successful research. We also believe that with the current collection of papers, we will be able to pay tribute to the union of Mineralogy and Crystallography.

1. Crystal Chemistry and Properties of Minerals and Their Synthetic Analogs

Gurzhiy et al. [2] reviewed the state of the art within the structural chemistry of uranyl carbonate minerals and mineral-related synthetic compounds. It was shown that the majority of synthetic analogs of uranyl carbonate minerals were grown from aqueous systems at room temperature, which indicates that the formation of these minerals in nature does not need any specific thermodynamic (increased P and T) conditions, as was assumed for other uranyl-bearing systems.

Kornyakov and Krivovichev [3] report on the crystallization of two novel synthetic phases with structures based on layers of oxocentered (OCu_4) tetrahedra, which were previously described in the structure of mineral shchurovskyite.

Huber et al. [4] have studied optical and spectroscopic characteristics of a number of *REE*-bearing (rare earth elements) minerals, such as loparite, lorenzenite, titanite, apatite and others, from massifs of Kola Peninsula (Khibiny, Lovozero, Afrikanda, and Kovdor), which can be regarded as indicator phases in intrusions of ultramafic and alkaline rocks.

The next two papers report on the synthesis and investigation of mineral-related materials with unique sorption characteristics. Samburov et al. [5] have synthesized an analog of the ivanykite mineral and studied its Pb sorption characteristics from model solutions. The maximal sorption capacity reached 400 mg/g at ambient conditions, which is very promising for metal excretion.

Kong and Jiang [6] suggest a protocol for zeolite material preparation from the coal gangue that is enriched by Fe and high quartz content. Technology includes preliminary calcination and leaching, and further activation by sodium carbonate at heating. This procedure appears to be less laborious and with higher product purity.

A further two papers that can be fitted within this chapter deal with the determination of H_2O molecules in structures of minerals. Wu et al. [7] have studied kaolinite and its polytype dickite by the means of near-IR spectroscopy, which helps to distinguish outer Al-OH bending vibrations at c.a. 4600 cm^{-1} and overtones of Al-OH stretching vibrations in the range of 7000–7250 cm^{-1}.

Using FTIR, Zuo et al. [8] have found the presence of H_2O molecules in the crystal structure of alkali feldspar within channels with preferable (001) orientation. It is suggested that this water plays an important role in the mechanisms of feldspar alteration and water preservation in nominally anhydrous minerals in Earth's depths.

2. Gemology

Wang et al. [9] report that there are two types of H_2O molecules that are arranged in the crystal structure of beryl. It was shown that $Fe^{2+} - Al^{3+}$ hetero-valent substitution shifts color of blue-green beryl from yellow to blue, which is also accompanied by an increase in H_2O content, whose symmetry axis is perpendicular to the *c*-axis.

Zhang et al. [10] have studied apatite of Paraiba-like color from Madagascar. It was shown that studied samples belong to the fluorapatite mineral species. The F/Cl ratio suggests the magmatic origin of apatites, and their fascinating greenish-blue color is caused by the presence of *REE* (Ce and Nd) elements and crystal structure distortion effects.

Peng et al. [11] report on the comprehensive experimental characterization of the natural forsterite crystals from a new locality in Jian forsterite jade (China). This Mg-bearing end member of the olivine group material is remarkable due to the enrichment in B, which comes from H and B substitution for Si.

3. Natural-Based Cement Materials

Costafreda and Martín [12] studied bentonites from the San José–Los Escullos deposit (Spain) that can be used in manufacturing durable cements and concretes. The studied rocks contain various clay and phyllosilicate minerals such as smectites of the montmorillonite variety, illite, vermiculite, biotite, muscovite, kaolinite, chlorite, etc. The conducted experiments demonstrated the pozzolanic character of the bentonites, which is very promising in the manufacture of pozzolanic cements.

In the second paper of this workgroup, Martín et al. [13] suggest a protocol for natural and calcined fluorite usage in the manufacture of cements. The authors showed that involvement of local fluorite deposits can help mining companies to reduce CO_2 emission and energy costs in the production of cement with good pozzolanic and mechanical properties.

Belmonte et al. [14] describe the pathway of the new cementitious material synthesis that can undergo self-healing, due to the addition of calcium nitrate to Portland cement. This results in the increase in the amount of ettringite crystals and sealing of fissures by them.

4. Biomineralogy

Pramono et al. [15] have successfully synthesized hydroxyapatite composite with spinel fittings using bovine bones, beverage Al cans and Mg (as the only commercial reagent). It was shown that the decrease in Al particle size increases hardness and reduces the porosity of the novel perspective biocomposite material.

5. Crystal Growth Techniques

Wang et al. [16] have found that syntheses of barite, at room temperature, in the presence of sodium and chlorine ions results in a low amount of rather simple morphologies, while a hydrothermal experiment significantly increased the variety of obtained crystal shapes. In addition, the dendritic type of crystalline barite can be considered as typomorphic for high temperature hydrothermal conditions, with an excess of Ba relative to sulfate ions.

Shakhgildyan et al. [17] have studied the role of gold nanoparticles on multicomponent glass crystallization, microstructure, and optical characteristics. It was shown that thermal precipitation of Au nanoparticles does not affect the crystallization and structure of glass and gahnite nanocrystals within the system, but strongly affects the optical properties of glass-ceramics.

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