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The forms of fluorite crystals as an important factor for prospect evaluation of mineralization (in case of deposits of tajikistan)

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Tajikistan is the fluorite-bearing region where minerals are extracted for the needs of the economy since the thirties of last century. There are many known fluorite deposits of different genetic types: carbonatite, pegmatite, greisen, skarn, hydrothermal, sedimentary-epigenetic. Fluorite is associated mineral in deposits of many kinds. Its industrial amounts there are in different silver-polymetallic sites.

Fluorite crystals occur in all genetic types of mineral deposits. However, a very wide variety of crystal-morphology forms are characterized in hydrothermal manifestations. Fluorite crystals were the subject of mining as an optical material in some of them. Unique by the cleanness, transparency and value Druze Crystals of optical fluorite were found in the Cooley Kalon Field in Zeravshan Range where the size of the largest crystal reached 25 cm in diameter and weighed 24 kg. Crystals of optical fluorite were mined in other ore fields (Mogov, Kaznok). Fluorite crystals have cubic, octahedral and rombododekaedric habitus forms and thereof combinations. In addition, there are more faces in tetragontrioktaedr (hkk), geksaoktaedr (hkl), tetrageksaedr (hko) and trigontritetraedr (hkk) positions. Some patterns, which can be used for prospecting and evaluation of the fluorspar deposits, were identified in detailed study of the crystals. Thus, the morphological change of one form of fluorite crystals to other was detected both in time and space. Changing shapes of crystals in time is expressed in their evolution from cube to octahedron, sometimes rhombododecahedr, from early to late generations of minerals. By slice study of deposits, habitus forms of crystals from cube to the octahedron, sometimes rhombododecahedr, has been established from early to later generations. The greatest interest has the change of crystal forms in space, i.e. along the rising of ore bodies as the ore-bearing mineral-solution moves up from source of hydrothermal vents. It is expressed in the finding of fluorite crystals of different habitus types in different hypsometric levels. It is allowing you to use this relationship for practical purposes. Change of some forms in other ore fields of different regions in Tajikistan subjects to the general rule but has some specific features. In the fields of northern Tajikistan, modified habitus forms of fluorite crystals from the lower to the upper levels of the deposit comes from the octahedron by cuboctahedron, cubo-rhombododecahedr and rhombododecahedr to the cube. For deposits of Central Tajikistan in the upper horizons, the crystals have a cubic habitus of facets (110) and (111), rarely (hkk); in the middle horizons the cuboctahedron crystals with approximately equal development of both forms are dominated, while at the lower levels octahedral shape complicated by the faces of the cube are present. In deposits of the Pamirs, the lower parts of the veins have developed octahedral crystals; in the middle – the rombododekaedric, and in the upper – the cubic habit types with (hkk), (hkl) sides and rarely (hko) are present.

Generalized model for the evolution of simple forms of fluorite crystals and combinations thereof from below upwards, from lower to upper levels of the deposit, has the order: (111) → 111) + (110) + (100) → (110) → (100) + (110) + (hkk) + (hkl) + (hko) → (100).

Such zoning in the distribution of fluorite crystals can be used to assess the level of erosional truncation and for prognosis of fluorite mineralization at depth. It was successfully implemented in prospecting and evaluation work for fluorspar mineralization in Central Tajikistan and the Pamirs.

Keywords: Fluorite, Crystal, Mineralizatiton

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Study of charge stripes and charge density waves using x-ray scattering

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Modulated structures due to the modulation in charge densities are observed in many material systems, especially in low dimensional materials, in common, and often accompany the occurrence of unusual transport behavior. In order to understand these unusual physical properties, it is therefore essential to study the correlations between the modulations and the transport behavior. Among the probes used for studying the charge modulations, synchrotron x-ray scattering has the merits of sensitivity to charges and high spatial resolution over others. Using synchrotron x-ray scattering, we report the study of charge modulations on both materials of $La_{2-x}Sr_xNiO_4$ (LSNO) and 2*T*-$TiSe_2$ (TS). LSNO is isostructural to the high T_C superconductor $La_{2-x}Sr_xCuO_4$, but it doesn't show superconductivity with any concentrations of Sr [1]. One of the reasons is ascribed to the formation of static charge modulations. Using high resolution x-ray scattering on 3 high quality single crystals of LSNO, with x = 0.225, 0.333, and 0.4, we observed the satellite reflections due to the formation of charge modulations. The q-wavevectors of the modulation vary with the hole concentrations, and the modulation are also observed to be two-dimensional in nature. Using azimuthal scan, the modulation are also demonstrated to show a two-fold symmetry, which is in agreement with the characteristic of charge stripes forming in the *ab* plane.

By contrast, 2*T*-$TiSe_2$ possesses a modulated structure due to the formation of charge density waves at low temperature. With a small amount of doping of Cu, 2*T*-$TiSe_2$ shows superconductivity at about 4K [2]. It was believed that both electronic states of superconductivity and CDWs compete with each other, however, experimentally, it has been demonstrated that both states can coexist with each other in some low-dimensional system, such as $NbSe_2$. In the case of 2*T*-Cu_xTiSe_2, Cu atoms could be regarded as the impurities to the CDWs, and result in the deformation of the CDW modulation. Using synchrotron X-rays, the spatial resolution can be easy reached as high as 10^{-4} Å^{-1}, x-ray scattering is therefore an ideal probe for studying the deformation of the modulated structure or lattice distortion. Using high resolution x-ray scattering on the parent compound 2*T*-$TiSe_2$, we have observed that TS possesses two types of modulation. One has the wavevector of q=(0.5 0.5 0.5), and the other is (0.5 0 0.5).

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Under the microscope: crystallographic and spectroscopic study of Rh(I) complexes

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The use of X-ray crystallography to determine the absolute coordination and structure is an undeniable advantage in trying

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