07.X-7 POLYHALOGENIDES OF BEDT-TTF AND ITS DERIVATIVES: LOW-DIMENSIONAL ORGANIC CONDUCTORS. By R.P. Shibaeva, USSR Academy of Sciences Institute of Chemical Physics, 142432 Chernogolovka, USSR

The review of crystal structures of cation-radical salts based on bis(ethylenedithio)-tetrathiafulvalene BEDT-TTF and its derivatives, in particular, bis(propylenedithio)-tetrathiafulvalene, BPDT-TTF, is presented:

a) BEDT-TTF polyiodides:
α-$(BEDT\text{-}TTF)_2I_3$,
β-$(BEDT\text{-}TTF)_2I_3$,
θ-$(BEDT\text{-}TTF)_2I_3$,
γ-$(BEDT\text{-}TTF)_3(I_3)_2(I_3)_{0.5}$,
δ-$(BEDT\text{-}TTF)I_3(C_2H_3Cl_3)_{0.333}$,
ε-$(BEDT\text{-}TTF)_2I_3(I_8)_{0.5}$, ζ-$(BEDT\text{-}TTF)_2I_{10}$,
η-$(BEDT\text{-}TTF)\cdot I_3$;
b) mixed polyhalogenides $(BEDT\text{-}TTF)_2X$, where $X = IBr_2$, I_2Br, ICl_2;
c) cation-radical salts $(BPDT\text{-}TTF)_2X$, where $X = I_3$, IBr_2, ICl_2;
etc.

Crystals of these salts are rich in their physical properties: dielectrics, organic metals with a metal-dielectric transition, organic metals stable in the whole range of temperatures, and superconductors.

One of the most frequent peculiarities of this type crystals is their polymorphism, on one hand, and isomorphism, on the other.

07.X-8 TWINNING IN FERROIC AND NONFERROIC CRYSTALS. By V.K. Wadhawan, Neutron Physics Division, Bhabha Atomic Research Centre, Trombay, Bombay 400 085.

A ferroic phase of a crystal results from a real or hypothetical phase transition involving a lowering of the point symmetry of the prototype. The orientation states (or domain states, or twin states) of the ferroic therefore differ in one or more macroscopic tensor properties. Twinning of the nonferroic type includes not only antiphase domains or translation domains (which can still be described in terms of a prototype symmetry), but also twinning in hcp, fcc and bcc crystals. The approach adopted by the author for obtaining a better understanding of the various types of twinning is to try to formulate a comprehensive and unified classification scheme for twinned crystals. Ideally, a physical criterion should be used for such a classification. No sufficiently general criterion of this type appears to available (at least at present). A symmetry criterion is therefore employed. The atomic structure of a crystal determines both its twinning characteristics and its space-group symmetry. The proposed classification scheme therefore works at the space-group level, unlike the earlier schemes of G. Friedel (1926) and Donnay and Donnay (1974). In the proposed scheme, if the twin-mapping operation (twin law) is a symmetry operation of an appropriately assignable prototype space group, the twin is called an "Aizu twin". Otherwise it is called a "Bollmann twin". Aizu twins are essentially transformation twins. They are further divided into ferroic twins and translation twins. Ferroic twins, in turn, can be of two types : ferroelastic or F-twins (e.g. the 90° twins of $BaTiO_3$), and nonferroelastic-ferroic or N-twins (e.g. the Dauphiné twins of quartz, and the 180° twins of $BaTiO_3$). The antiphase domains in Cu_3Au are a typical example of translation twins (T-twins). The three types of Aizu twins (F, N and T) have distinctive macroscopic physical properties : F-twins always differ in a second-rank polar tensor property (the 90° twins of $BaTiO_3$ differ in spontaneous strain); N-twins always differ in at least one tensor property other than a second-rank polar property (Dauphiné twins of quartz differ in the sign of the compliance coefficient s_{1123}); T-twins do not differ in any tensor property at all. Such a distinction in terms of physical properties is not possible for Bollmann twins. Bollmann twins are divided into two main categories: coincidence-lattice twins (C-twins), and miscellaneous twins (M-twins). C-twins are further categorized into three types, depending on the "total" or "partial" nature of the three-dimensional coincidence sublattice. Brazil twins of quartz are an example of C-twins with a partial sublattice, whereas twinning in fcc metals has a total coincidence sublattice. M-twins can also be of three types (M_0, M_1 and M_2), depending on the dimensionality of the dichromatic pattern being 0, 1 or 2. The presently accepted definition of a twin stipulates that the twin law be "well defined" or uniquely specified for a given twin species. If this uniqueness requirement is relaxed, regions of a crystal separated by grain boundaries and stacking faults become classifiable as subcategories of M_0 twins.