# ON THE FORMATION OF CAVITIES IN THE PARATELLURITE CRYSTALS

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Present paper deals with formation of micro- and macro-cavities in the crystal bulk of paratellurite ($\alpha$-$TeO_2$) produced by pulling out from the melt using the Czochralski method. They are one of the most typical non-uniformities of crystal structure related, in our opinion, to the physical and chemical properties of tellurium dioxide melt, which is capable of dissolving considerable amounts of gaseous substances. During crystallization any of the above gaseous substances are extracted from the melt under the influence of hydrostatic extrusion forces and move towards its surface. Some fraction of them is picked-up by the melt flows and transported to the crystallization front, where it is captured by the crystal surface or repelled by the front similarly to the impurities with segregation coefficient less than a unit.

Our studies have shown that the 'bubbles' occur not only in close vicinity of growth bands (the so-called 'band structure') but at its transparent areas as well. Note that in any case their size and location in the crystal bulk completely depend on the growth rate conditions and crystallization front shape. We have analyzed the kinetics of cavity appearance at different crystallization front shapes and suggested the mechanisms of their production.

When producing the paratellurite crystals, a very special role is played by their crystallization with crystallization front being concaved inside the crystal, since such form of 'crystal-melt' distribution favors occurrence of gaseous inclusions in the central part of the crystal, as well as formation of macroscopic cavities in its bulk of several cubic centimeter volume.

Spontaneous formation of the cavity in the paratellurite crystal bulk during crystallization is possible not only due to extraction of gaseous substances in the sub-crystal domain, but also under violation of bottom crystal part contact with melt. This was observed at the concave crystallization front due to predominance of the melt column weight over the surface tension forces, which hold it in contact with the bottom part of crystal. Contact of the central part of the crystal with melt vanishes momentarily and occurs at the ring peripheral part only, while rarefication produced in the cavity due to the crystal pulling-out will increase and finally result in complete detachment of crystal from the melt.

The principle of extraction of gaseous substances from the melt into the sub-crystal domain has made a ground of the method that allows crystals with internal cavities to be grown. Such hollow crystals could be used as chemical reactors, containers for synthesizing and growing various crystals, optical cuvettes and/or screening elements for crystallization units, since any of the above principles of cavity formation could be applied to crystallization of a wide class of materials.