Single Crystal Growth and Characterization of Pyroelectric L-arginine Dibromide Monohydrate (LADB)

Danghyan AA[1], Khachatryan LA[1], Apreyan RA[1], Ter-Balyants SA[1], Atanesyan AK[1], Sukiasyan RP[1*],
*Sukiasyan RP:ruzas73@gmail.com
1Institute of Applied Problems of Physics, NAS of Armenia, 25 Nersessyan Str., 0014 Yerevan, Armenia.

Salts of optically active L–amino acids, in particular L–arginine, crystallize in enantiomorphous space groups $P2_12_12_1$, $P2_1$, P1 and very rarely in others. These space groups being acentric allow displaying nonlinear optical and piezoelectric properties, while polar $P2_1$ and P1 groups, also a pyroelectric effect. Systematic investigations of L–arginine salts started from the study of halides in the beginning of the sixties [1,2]. It's worth noting that being a subject of numerous studies, the crystal triglycine sulfate (TGS) among amino acid salts [3], has been widely used in various fields as an infrared receiver sensor, particularly in military technology. Note that our team reported about the obtaining, structure and pyroelectric properties L-Arg·2HBr·H_2O (P1) (LADB) crystals back in 2004 [4]. LADB crystal has good pyroelectric properties, the parameter of which (γ/ε=6.8 $\mu Cm^{-2}K^{-1}$) is comparable to the parameter of the known TGS crystal (γ/ε=11 $\mu Cm^{-2}K^{-1}$). However, the temperature dependence of the pyroelectric coefficient allows the LADB crystal to be used over a wider temperature range (up to 345 K) compared to the TGS crystal (up to 322 K) [4]. The L-Arg·HBr·H_2O crystal and its pyroelectric properties have recently been studied in details [5].

However, so far attempts in obtaining LADB, therefore the conditions for the formation of all compounds from L-Arg+HBr+H_2O system were studied and described in this study. Solutions were prepared in L–Arg:mHBr molar ratio, where m=1÷9 and changes by 0.25 steps, at 0–33°C temperature. The main difficulty of crystallization of L–Arginine bromides is connected to very high solubility in water. The latter has prompted us to develop a straightforward method for obtaining and growing crystals with improved optical qualities, where large size singles crystals were also accomplished. The achieved high qualities of the crystal LADB allow us to highly anticipate will be widely used as a pyroelectric crystal. Conditions for crystal growth were studied and a high quality crystal (Fig. 1) was grown by SER method. This method was developed and named by the authors. Solubility was determined by a method of sequential dissolution of decreasing amounts at a given temperature. The grown crystals were subjected to etching and microhardness studies. Thermal properties, vibrational spectra, UV-Vis transmittance spectrum were also investigated. The crystal has birefringence.

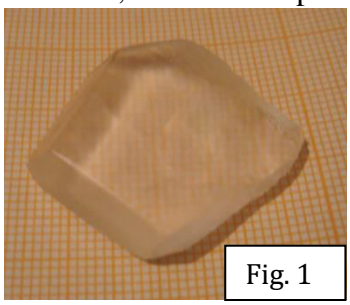

Fig. 1

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