MICROSTRUCTURAL AND VIBRATIONAL PROPERTIES OF PVT GROWN Bi_2Te_3 CRYSTALS

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Bismuth telluride, Bi_2Te_3, is a well-known thermoelectric material. Besides, for several recent years Bi_2Te_3 has been of great interest because of topological insulator properties. The formation of Bi_2Te_3 crystals with high-quality structure is of prime importance for comparative diagnostics of thin films and nanostructures fabricated by epitaxial and chemical synthesis techniques. In present study the high-quality Bi_2Te_3 microcrystals have been grown by physical vapor transport (PVT) method without using a foreign transport agent. High purity (4N) elementary Bi and Te used as starting reagents were additionally purified by directional crystallization. The growth experiment was performed in a fuzzed quartz ampoule An element charge of 15 g prepared in stoichiometric composition Bi:Te = 2:3 was filled into the ampoule and then it was sealed at residual pressure ~10^{-4} bar. Bi_2Te_3 melt was used as a source to have a higher vapor pressure and, respectively, increased crystal growth rate. The microcrystals grown under optimal temperature gradient are well facetted and they have dimensions up to ~ 100 μm as shown in Fig. 1. The phase composition of grown crystals has been identified by X-ray single crystal structure analysis in space group *R*-3*m*, *a* = 4.3896(2) Å, *b* = 30.5019(10) Å, *Z* = 3 (*R* = 0.0271). Raman microspectrometry has been used to describe the vibration parameters of Bi_2Te_3 microcrystals. The FWHM parameters obtained for representative Raman lines at 61 cm^{-1} and 101 cm^{-1} are as low as 3.5 cm^{-1} and 4.5 cm^{-1}, respectively.

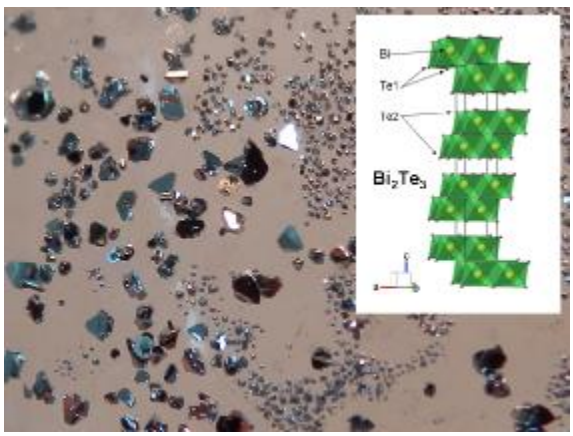

Fig.1. PVT grown Bi_2Te_3 microcrystals.