Growth of pure and doped $Bi_4Si_3O_{12}$ single crystals for optical applications

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Bismuth silicate ($Bi_4Si_3O_{12}$, BSO) crystal is an important scintillation material. Its decay time is about 100ns, faster than that of $Bi_4Ge_3O_{12}$ (BGO). The light yield of BSO is about 2000ph/Mev, higher than that of $PbWO_4$ (PWO). Thus, BSO crystal is considered as a promising candidate for fabricating dual-readout calorimeters. Furthermore, doped BSO crystals are multi-functional materials with superior properties, such as luminous performances, high hardness, large specific heat, small thermal expansion, high optical damage threshold and so on. However, it is difficult to grow large size BSO crystals due to segregation. In the present work, pure and doped $Bi_4Si_3O_{12}$ single crystals have been grown by the modified vertical Bridgman method. Large size BSO crystals were obtained for scintillation application. Rare-earth doped BSO crystals were developed for phosphor and laser applications.