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Mechanical robust BiSbTe alloys with superior thermoelectric performance:A case study of stable hierarchical nanostructured thermoelectric materials[1] XIANLI SU, YUN ZHENG, XINFENG TANG, Wuhan University of Technology, CTIRAD UHER, University of Michigan, TANG'S GROUP TEAM, UHER'S GROUP TEAM — Poor machinability and susceptibility to brittle fracture of commercial ingots often impose significant limitations on the manufacturing process and durability of thermoelectric devices. In this study, melt spinning combined with plasma activated sintering (MS-PAS) method is employed with commercial p-type zone-melted (ZM) ingots of $Bi_{0.5}Sb_{1.5}Te_3$. This fast synthesis approach achieves hierarchical structures and *in-situ* nanoscale precipitates, resulting in the simultaneous improvement of thermoelectric performance and mechanical properties. Benefitting from a strong suppression of the lattice thermal conductivity, a peak ZT of 1.22 is achieved at 340 K in MS-PAS synthesized structures, representing about a 40% enhancement over that of ZM ingots. Moreover, MS-PAS specimens with hierarchical structures exhibit superior machinability and mechanical properties with an almost 30% enhancement in the fracture toughness, eightfold and a factor of six increase in the compressive and flexural strength respectively.

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