Growth of Bismuth Palladium single crystals by optical floating zone technique

Raja Arumugam[1]*, Rosalba Fittipaldi[2], Anita Guarino[1], Alberto Ubaldini[2], Mariateresa Lettieri[1], Daniel Mayoh[3], Geetha Balakrishnan[3] and Antonio Vecchione[1].
*lead presenter: rajaphy014@gmail.com
1 CNR-SPIN, c/o University of Salerno, I-84084, Fisciano, Salerno, Italy
2 ENEA, Dept Fus & Technol Nucl Safety & Secur, Rome, Italy
3 Department of Physics, University of Warwick, Coventry CV4 7AL, United Kingdom

Due to the rarity of triplet pairing, topological superconductors (SCs) have primarily been realized experimentally in manufactured topological phases, such as heterostructures, where the proximity effect causes triplet pairing with traditional s-wave SCs [1,2]. Recently, there has been a lot of interest in investigating novel quantum materials with spin-triplet pairs in order to develop Majorana physics and creating quantum computers. Superconductor-based qubits have emerged as one of the top contenders for scalable quantum processors [3,4]. In this work, we present the crystal growth of α-BiPd and β-Bi_2Pd single crystals using the optical floating zone technique and their characterization. The single crystals of α-BiPd and β-Bi_2Pd are found to crystallize in monoclinic and orthorhombic crystal system with space group $P2_1$ and $Cmc2_1$, respectively. The composition and microstructure of the grown crystals were analyzed with a scanning electron microscope, through energy dispersive spectroscopy (EDS) and electron backscattered diffraction (EBSD) analysis. The superconducting behavior of both α-BiPd and β-Bi_2Pd single crystals was tested by electric resistivity measurements.

References

[1] Mourik, V. et al. Signatures of Majorana fermions in hybrid superconductor-semiconductor nanowire devices. Science 336, 1003–1007 (2012).
[2] Armitage, N. P., Mele, E. J et al., Weyl and Dirac semimetals in three-dimensional solids. Rev. Mod. Phys. 90, 015001 (2018).
[3] Lv, B. Q., Qian, T et al., Experimental perspective on three-dimensional topological semimetals. Rev. Mod. Phys. 93, 025002 (2021).
[4] Tian Shang and Sudeep K. Ghosh, Spin-triplet superconductivity in Weyl nodal-line semimetals, npj Quantum Mater. 7, 35 (2022).