Crystal Growth and Properties of Novel Quantum Materials

Amir-Abbas Haghighirad[1]

[1]*Institute for Quantum Materials and Technologies, Karlsruhe Institute of Technology, Karlsruhe D-76021, Germany*
e-mail: amir-abbas.haghighirad@kit.edu

In this contribution, I will focus on four families of materials, $BaNi_2(As_{1-x}P_x)_2$ [1], $FeSe_{1-x}S_x$ [2-3] $Ta_2(Ni_{1-x}Co_x)Se_5$ [4] and $CrAs_{1-x}P_x$ [5], that show rich phase diagrams containing nearly degenerate electronic states. In these materials the electronic properties (e.g. nematicity, charge- and magnetic ordering) can be altered by tuning the interplay between the structural and electronic degrees of freedom, for instance by chemical doping or by applying hydrostatic pressure. The prerequisite for detailed experimental exploration, is the design and crystal growth of high-quality singly crystals. We have been implementing chemical vapor transport and crystallization by flux for the growth of the selected materials enabling us to study the phenomena of interest under well-controlled conditions. A series of high-quality single crystals of $BaNi_2(As_{1-x}P_x)_2$, $Ta_2(Ni_{1-x}Co_x)Se_5$, $FeSe_{1-x}S_x$ and $CrAs_{1-x}P_x$ have been grown and characterized by chemical analysis, x-ray diffraction and magnetic measurements (see Figure 1). I will explain the current experimental status of the measurements and discuss promising future directions.

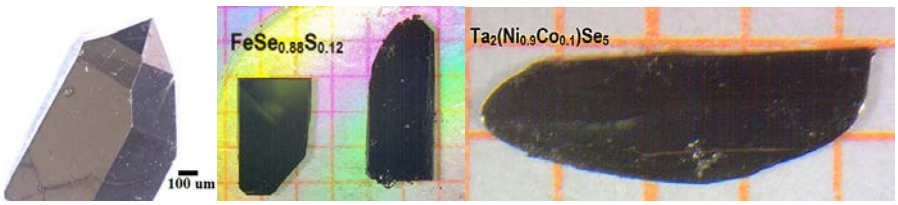

Figure 1: Single crystals of $CrAs_{0.97}P_{0.03}$, $FeSe_{0.88}S_{0.12}$ and $Ta_2(Ni_{0.9}Co_{0.1})Se_5$.

References

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