The enhancement of thermoelectric properties of hole doped-polycrystalline $Sn_{1-x}Fe_xSe$

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Thermoelectric (TE) materials provide an efficient technology to contribute to solving global energy crisis because they can harvest waste heat and convert it to electric energy. Single crystal p-type SnSe samples show an exceptionally high figure of merit (ZT) of ~2.2-2.6 at 923 K, which is attributed to ultralow thermal conductivity due to highly anharmonic bonding characters. However, single crystal samples are unsuitable for mass production and application for practical device fabrication because they require a long time for synthesis and expensive preparation processes. Although polycrystalline SnSe samples have advantages for device applications because they have machinability and scalability, they perform much poorer than single crystal samples. As a result, improving TE properties of polycrystalline SnSe samples have been one of the most important tasks in TE community.

In this presentation, we report the doping effect of Fe for polycrystalline SnSe systems to improve their TE performance. At the optimal level, Fe doped SnSe enhance power factor due to the increase electroconductivity. As a result, the best performing system achieves a high ZT larger unity at 800K.