

## **Preparation of polycrystalline $\text{FeTe}_{1-x}\text{S}_x$ ( $x = 0.00\text{--}0.30$ ) via solid-state reaction method at ambient pressure**

### **ABSTRACT**

Polycrystalline samples with nominal composition  $\text{FeTe}_{1-x}\text{S}_x$  ( $x = 0.00\text{--}0.30$ ) were synthesized via solid state reaction method with intermittent grinding in argon gas flow. X-ray diffraction (XRD) patterns revealed the tetragonal structure (space group  $P4/nmm$ ) of the samples with the presence of impurities  $\text{Fe}_3\text{O}_4$  and  $\text{FeTe}_2$ . By substitution with S, the  $a$  and  $c$  lattice parameters shrink probably due to the smaller ionic radius of  $\text{S}^{2-}$  compared to  $\text{Te}^{2-}$ . Scanning electron microscopy images showed that the samples developed plate-like grains with increasing S substitution. Substitution of Te with S suppresses the structural transition of the parent compound  $\text{FeTe}$  as shown by both the temperature dependence of resistance and magnetic moment measurements. All of the S-substituted samples showed a rapid drop of resistance at around 96 K but zero resistance down to 4 K was not observed. In addition, negative magnetic moment corresponds to diamagnetism was detected in the samples for  $x = 0.25$  and  $0.30$  suggesting the coexistence of magnetic and superconducting phase in these samples. The magnetization hysteresis loops measured at room temperature showed ferromagnetic behavior for the pure and S substituted samples. However, the magnetization, remanence and coercivity decreased with S content.

**Keyword:** Polycrystalline;  $\text{FeTe}_{1-x}\text{S}_x$  ( $x = 0.00\text{--}0.30$ ); Solid state reactions