Room temperature dielectric properties of polycrystalline FeTe$_{1-x}$Se$_x$ ($x = 0.0–0.5$)

ABSTRACT

In this work, frequency-dependent dielectric properties of polycrystalline samples with nominal compositions FeTe$_{1-x}$Se$_x$ ($x = 0.0–0.5$) were investigated. The samples were synthesized via solid-state reaction method with intermittent grinding at ambient pressure. The phase formation, lattice properties and chemical compositions of the samples were analysed. Dielectric constants ($\varepsilon'$, $\varepsilon''$), dielectric loss (tan $\delta$) and alternating current (AC) conductivity (\(\sigma_{\text{ac}}\)) as a function of frequency ranging from 100 Hz to 10 MHz were measured at room temperature. X-ray diffraction (XRD) data showed the presence of impurity phases of Fe$_3$O$_4$, FeTe$_2$ and hexagonal FeSe/Fe$_7$Se$_8$. Both a and c lattice parameters decreased with the substitution of Se. Energy-dispersive x-ray spectroscopy confirmed the increasing ratio of Se/Te with $x$. The measured negative values of real dielectric constant ($\varepsilon'$) for $x = 0.0–0.5$ indicate the conductive nature of these samples. As the Se content was increased, the $\varepsilon'$ became more negative as a result of better grain connectivity as shown by the higher AC conductivity and dielectric loss.

**Keyword:** FeTe; Se substitution; X-ray diffraction; Dielectric properties