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Two step transition and suppression of monoclinic distortion in FeTe doped with nickel

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FeTe is a non-superconducting member of "11" family of iron based superconductors [1]. It has been found to become superconducting (SC) upon doping with sulfur or selenium [1,2], which is precursored by disappearance of the low temperature monoclinic (or orthorhombic) distortion of the tetragonal lattice.

The other parameter critical for the SC is the amount of the interstitial iron [1,2], which we want to control by doping with nickel. Our preliminary low temperature laboratory XRD on Cr and Ni [3] series did not reveal any structural deformation upon cooling, which was a very promising result. Unfortunately, high resolution neutron powder diffraction carried at the NIST Center for Neutron Research revealed that the distortion is still present albeit gradually suppressed upon doping in Cr series [4].

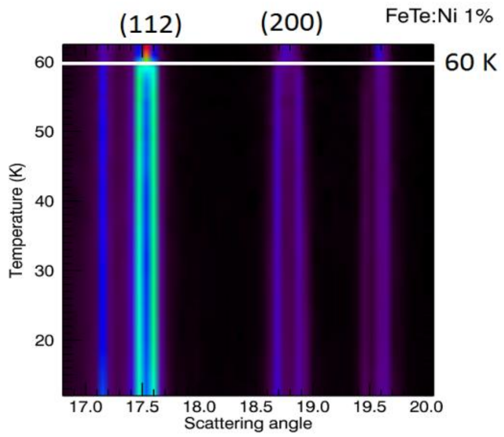

Figure 1. Monoclinic distorsion in $Fe_{1.09}Ni_{0.01}Te$ seen by splitting of (112) and (220) peaks of the tetragonal cell.

Here we report our preliminary results of low temperature powder XRD performed on ground single crystals of FeTe doped with nickel, which reveals splitting and suppression of the structural phase transition in nickel doped system. The low temperature high resolution X-Ray diffraction (HRPD) studies have been carried out at ESRF CRG SpLine [5] beamline.

The evolution of structural transition was followed by monitoring (112)t, (200)t peaks of the tetragonal unit cell. Reflection (112)t is sensitive only to monoclinic distortion and splits into (1-12)m and (112)m, whereas (200)t splits into (200) and (020) in both monoclinic and orthorhombic cells.

Sample with 1% doping (Figure 1) revealed only small decrease of the transition temperature to 60K without removing the monoclinic distortion. On the other hand, doping with 5% of nickel showed significant lowering of the transition temperature to 30 K and almost complete suppression of monoclinic distortion.

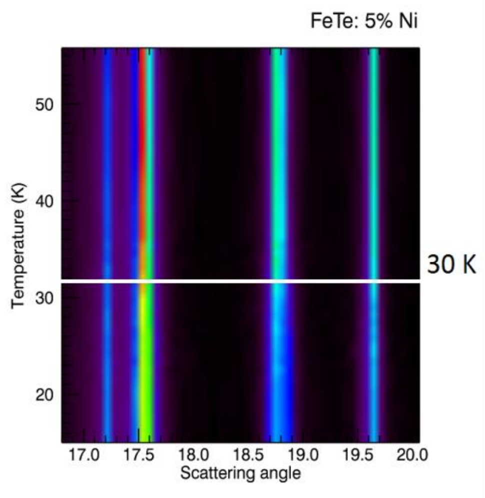

Figure 2. Splitting of temperatures of monoclinic and orthorhombic transitions in $Fe_{1.09}Ni_{0.01}Te$.

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