Superconducting and structural properties of pure $FeTe_{1-x}Se_x$ $(0.3 < x < 0.5)$ and Co, Ni, and Cu substituted $Fe_{1\pm\delta}Te_{0.65}Se_{0.35}$ single crystals

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The superconducting single crystals of $FeTe_{1-x}Se_x$ $(0.3 < x < 0.5)$ and $Fe_{1\pm\delta}Te_{0.65}Se_{0.35}$ $(\delta \approx 0)$ doped with Co, Ni or Cu have been grown applying Bridgman's method. Obtained crystals of the highest crystallographic quality exhibit cleavage plane (001) and well-developed (100) and (101) planes. Changes of chemical composition along the crystal growth direction were found to be negligible as estimated by x-ray and SEM/EDX analysis. Crystallographic quality of the crystals defined as $\Delta\omega$ value of 004 Bragg peak is inversely correlated with the sharpness of the transition to the superconducting state. It may indicate that the existence of defects in single crystals supports superconductivity.
The superconductivity is completely suppressed in $Fe_{1\pm\delta}Te_{0.65}Se_{0.35}$ by partial replacement of Fe ions by slight amount of nonmagnetic Cu ($\sim$ 1.5 at%) or by magnetic Ni ($\sim$ 2 at%) and Co ($\sim$ 5 at%) ions. It means that magnetic disorder introduced by ions with spin values different than that of host lattice suppresses superconductivity.