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# Phase segregation and alteration in superconducting properties caused by substitution of palladium for iron in $Fe_{1.02}Se_{0.5}Te_{0.5}$

© N.V. Selezneva[1], A.S. A Abouhaswa[1,2], E.V. Kislov[1,¶], N.V. Baranov[3]

[1] Institute of Natural Sciences and Mathematics, Ural Federal University named after the first President of Russia B.N. Yeltsin, 620083, Ekaterinburg, Russia
[2] Physics Department, Faculty of Science, Minufiya University, 32511, Shebin El-Koom, Egypt
[3] M.N. Miheev Institute of Metal Physics, Ural Branch of the Russian Academy of Sciences, 620108, Ekaterinburg, Russia

¶ E-mail: eu.kislov@gmail.com

*Received: September 22, 2020*
*Revised: October 2, 2020*
*Accepted: October 6, 2020*

A series of polycrystalline samples with nominal compositions $Fe_{1.02-x}Pd_xSe_{0.5}Te_{0.5}$ ($x = 0$, 0.02, 0.05, 0.1, 0.15, 0.2) has been synthesized and studied by means of the $X$-ray diffraction, scanning electron microscopy, electrical resistivity and magnetization measurements. An increase in the Pd content above $x = 0.02$ leads to the phase segregation and the appearance of a non-superconducting tetragonal FeSe-like phase and a PdTe-type hexagonal phase along with the superconducting FeTe-like phase. The unit cell volume of the FeTe-like and FeSe-like phases is observed to increase and decrease, respectively, when the Pd content increases. Such a behavior is ascribed to the redistribution of selenium and tellurium between coexisting phases. It has been shown that the revealed changes in the composition and volume fraction of the superconducting FeTe-like phase with increasing Pd content are the main reason for the decrease in the critical temperature and critical current density in $Fe_{1.02-x}Pd_xSe_{0.5}Te_{0.5}$.

**Keywords:** iron chalcogenides, phase composition, phase segregation, crystal structure, superconductivity.

**Acknowledgements**
Authors are grateful to Dr. A.F. Gubkin for the assistance in preparing the Pd-containing samples and to Dr. D.K. Kuznetsov for the SEM measurements.

**Foundation**
The present work was supported by the Ministry of Education and Science of Russia (project FEUZ-2020-0054 and theme No AAAA-A18-118020290129-5).