Mössbauer Spectroscopy of Iron-based Chalcogenides

Valentin N. Ivanovski

Abstract*—Soon after the discovery of superconductivity in LaFeAsO with T_C = 26 K in 2008, many other iron-based superconductors were synthetized. They are all based on the layers which contain iron and a pnictogen (As, P) or a chalcogen (S, Se, Te) element. Due to the connection between superconductivity and magnetism these novel unconventional high-T_C superconductors have attracted tremendous interest in the scientific community. A particularly well studied is tetragonal FeSe in the PbO type structure (11 family). The improvement of T_C was achieved by the intercalation of an additional layer such as perovskite-like blocks or alkaline metals into the Fe-based chalcogenide layered systems. This led to creation of new superconducting compounds, $A_yFe_{2-x}Se_2$ (*A* is an alkaline element) named 122 family whose physical and structural properties are found to be very sensitive on details of the chemical composition. Unlike layered cuprate superconductors, a cationic disorder arisen from a substitution in an Fe-layer improves T_C. The highest T_C in the Fe-based chalcogenide superconductors is accomplished by suppression of both long range crystallographic and magnetic order. Mössbauer spectroscopy is a very useful tool for studies of structural phase transitions, structure defects, and chemical and structural inhomogeneities. This lecture is devoted to the local structure studies of $FeSe_xS_{1-x}$, $K_{0.7}Na_{0.1}Fe_2Se_2$, $KFe_{1-x}Co_xSe_2$, and similar Fe-based chalcogenide compounds using the Mössbauer spectroscopy.

***Index Terms*—Superconductors; iron-based chalcogenides; Mössbauer spectroscopy; local structures.**

Valentin N. Ivanovski is with the "Vinča" Institute of Nuclear Sciences - National Institute of the Republic of Serbia, University of Belgrade, P.O.Box 522, 11001 Belgrade, Serbia (e-mail: valiva@vin.bg.ac.rs).