FINAL REPORT

Project PIEF-GA-2009-254511 (HEUSPECTRO)

PUBLISHABLE SUMMARY

Heusler compounds, with a general composition X_2YZ or XYZ (with X, Y being a transition metal and Z an element from the III-V groups) are attracting interest due to their possible use in many applications, such as half-metals, topological semiconductors, magnetic semiconductors, compensated ferrimagnets, thermoelectric materials, caloric materials etc. The interest in Heusler compounds comes from large commutability of the composing elements, related with large tunability of the electronic structure, allowing to optimize the desired material properties.

The goal of this project was to study Heusler compounds using optical spectroscopies, such as ellipsometry, infrared spectroscopy or magneto-optical Kerr effect. The project was a single-beneficiary Marie-Curie Action Intra-European Fellowship (IEF), with project acronym HEUSPECTRO. The project allowed the fellow, Jaroslav Hamrle, PhD, to stay and work two years in VSB-Technical University of Ostrava (VSB-TU Ostrava). The project was headed by Prof. Jaromír Pištora, director of Nanotechnology Centre.

The scientific objective of the project was study of Heusler compounds by means of optical spectroscopies. The work has been performed in collaboration with many Universities and Institute in Germany and Japan, namely Mainz University, Kaiserslautern University, Max-Planck Institute in Dresden, Osnabrück University, Bielefeld University, Tohoku University and RIKEN. During the project, various types of Heusler compounds has been investigated, such as half-metals, topological insulators, thermoelectric materials or caloric materials. The investigations provided better understanding of the electronic structure, such as phonon energies, gap size and its purity, shape of critical points, presence of quasi-particles such as excitons, conductivity estimation from IR absorption, etc. The optical spectroscopy also proved important to check correctness of the ab-initio calculations, by comparing the experimental and calculated optical spectra.

In the course of the project, the fellow also profited from his training, by enhancing his knowledge and securing his future carrier. Namely, the fellow has become familiar with optical spectroscopy techniques and data interpretation, as well as he has actively participated on upgrading the optical systems. Furthermore, he has lead several teaching courses in Physics, providing transfer of knowledge to students. He has organized study-stays for students from VSB-TU Ostrava to foreign Universities as well as inviting students from abroad to study-stays in VSB-TU Ostrava. The fellow himself also attended several international conferences, as well as he visited several laboratories abroad. Finally, the fellow has given several talks and lessons, providing transfer of knowledge between local scientists and the fellow.

Regarding the dissemination of the project, several action has been undertaken, such as presentation of the project during talks and lessons, transfer of knowledge between the fellow and University stuff, pedagogical activities, supporting student mobility or wide audience presentations, such as University's open-day.

In wider perspective, the project is helping to transform our university from original technical university into field of new materials and nanotechnology research. In fact whole Ostrava region is recently undergoing a long and painful transformation from heavy industry (such as steel making) to a advanced high-tech industry, based on nanotechnology and new material development. In this perspective, the stay of persons such as the fellow are important for whole region.