

## CERTIFICATE OF THE SCIENTIFIC TRAINING

Scientific training of **A.G. Razumnaya**, senior assistant at the Department of Nanotechnology, Southern Federal University, took place at the Laboratory of Condensed Matter Physics of the University of Picardy (UPJV, Amiens, France) for the period from 1<sup>st</sup> of October to 30<sup>th</sup> of November 2014 within the framework of the European Marie Curie collaboration project: Seventh Framework Programme (FP7) Initial Training Network «Novel Type of Terahertz Devices – NOTEDEV». The objectives of research training were:

- ✓ to design and model tunable 2D and 3D micro- and nanostructured ferroelectric and multiferroic materials in the form of bulk ceramics, single layer thin films, superlattices structures made by a ferroelectric layer and a magnetic layer, and multilayer structures built up from alternating dielectric/ferroelectric and magnetic layers to optimize the magnetoelectric coupling between the layers
- ✓ to investigate new materials for ferroelectric and multiferroic THz devices for further application in THz devices and to analyze the dynamical properties of these structures with the aim to produce materials and heterostructures possessing by the optimized properties for device applications.

**A.G. Razumnaya** acquired the following practical and theoretical skills:

- ✓ Thin film deposition by means of Pulsed Laser Deposition and Sputtering for preparation of single layer thin films, multilayer structures, and superlattices;
- ✓ X-ray diffraction methods to investigate epitaxial growth, lattice distortions due to epitaxial strain, modulation periods of the superlattices;
- ✓ Raman scattering technique to study lattice dynamics of bulk ceramics, thin films and superlattices in the broad temperature intervals with the aim to investigate phase transitions in these materials;
- ✓ Modeling of polarization switching phenomena in ferroelectric thin films.

The skills and knowledge acquired during the scientific training can be used at the developing of the advanced courses in Nanotechnology, Material Science of Nanosystems and Physics of Materials for university-level bachelor and master students.

FACULTÉ DES SCIENCES  
 LABORATOIRE DE PHYSIQUE DE  
 LA MATIÈRE CONDENSÉE  
 33, rue Saint-Léon  
 80039 AMIENS CEDEX - France  
 Tél. 03 22 82 76 24

Amiens, 30 November 2014

I. LUKYANCHUK

Professor

Coordinator of the FP7 Initial Training Network  
«Novel Type of Terahertz Devices – NOTEDEV».