DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)

Development in modern material physics is related with better understanding of the physical phenomena that generally requires new methodologies for the experimental investigation of the material properties. Very recently, nano-structured materials have attracted much research activities because of their particular properties which differ from those of bulk materials. Among them semiconductor superlattices have gained much attention because they exhibit new features which are used in modern micro- and optoelectronics. However, a fundamental knowledge of the thermal properties is required for device designing, production and device exploitation. For this reason it is of great importance to develop measurement strategies able to characterize the thermal properties of the superlattice in different directions. In this project a contactless method will be worked out for thermal properties characterization (thermal conductivity, thermal diffusivity, thermal boundary resistance) of the superlattice systems. The method will be applied to AlAs/GaAs superlattices to investigate the interface effects on the thermal transport properties. The aim of this project is to prove experimentally the theoretical predictions made by the molecular dynamics calculations and to get a more detailed information on the relative contributions of the interface and of the layer to the in-plane and the cross-plane thermal conduction using contactless photothermal radiometry (PTR). In order to accomplish this research task a the methodology based on the thermal waves method and their infrared detection using PTR method is chosen. Thermal waves are temperature oscillations which are produced by an intensity modulated laser beam (frequency domain PTR). The PTR amplitude and phase will be analyzed by theoretical model which enable to study the effect of thermal interface resistances on thermal conduction in multi-layered samples in cross-pane can be done. Moreover, the PTR investigation of the thermal transport parallel to the surface of the layers will be undertaken. Altogether it should give a unique methodology able to measure thermal properties in cross-plane and in-plane directions of superlattices. In order to control or to verify parameters which can have an impact on the PTR signal supplementary measurements will be conducted, such as : far- and mid-infrared FTIR spectroscopy, Hall measurements and Scanning Thermal microscopy in laboratories involved in this project. The PTR measurement will be performed in temperature range between -196°C and 350°C.