

IN MEMORIAM NICOLAE POPOVICI



(December 19, 1943 – March 7, 2015)

Nicolae Popovici was born on December 19, 1943 in the Sarateni village, Telenesti district. In 1962–1967, he was a student of the Faculty of Physics and Mathematics of the A. Russo State University. N. Popovich began his academic activity as a physics teacher in a secondary school in the Bratusenii Vech village, Edinet district in 1967. In 1970–1974, he was a post-graduate student at the Institute of Applied Physics of the Academy of Sciences of Moldova.

N. Popovich defended his candidate's dissertation in 1976 and his doctoral dissertation in 1986 (both on physics and mathematics); in 1990 he became Professor in physics of semiconductors and dielectrics. After post-graduate courses at the Institute of Applied Physics of the Academy of Sciences of Moldova, N. Popovici worked at the same institute as an inferior researcher (1974–1978), a senior researcher (1978–1986), a leading researcher (1986–1988), head of the Laboratory for physics of anisotropic semiconductors (1988–2006), and a principal researcher (1996–2006). Since 2006, he was principal researcher at the Gitsu Institute of Electronic Engineering and Nanotechnologies of the Academy of Sciences of Moldova.

As a result of scientific activity for more than four decades, Prof. Popovici has laid the foundation of a new scientific direction in condensed matter physics—physics of $A^{III}B^VC_2^{VI}$ semiconductors and alloys thereof with $A^{IV}B^{VI}$.

The basic developments that have determined the success of research in this field primarily include the growth technology for $A^{III}B^VC_2^{VI}$ semiconductors and alloys thereof, which was developed in strict accordance with respective state diagrams. The high quality of the crystals obtained by Prof. Popovich during these years was repeatedly confirmed at various scientific centers in Russia, Ukraine, Lithuania, Germany, the Czech Republic, and other countries. A particularly convincing evidence of the high quality of $TlSbTe_2$ and $TlBiS_2$ crystals is the Shubnikov-de Haas oscillations, which have been first detected in crystals of this type.

Of particular interest are the results of Prof. Popovich in the study of the optical and photoelectric properties of layered TlSbTe_2 and TlBiS_2 semiconductors, $(\text{TlSbS}_2)_{1-x}(\text{TlSbSe}_2)_x$ solid solutions, and electronic devices based on these crystals. In recent years, physics of layered semiconductors has become a separate scientific direction; we believe that an important role in the formation of this research trend rightfully belongs to Prof. Popovici and his disciples.

Another area of research of Nicolae Popovici is related to studying the electrophysical properties of rhombohedral $\text{A}^{\text{III}}\text{B}^{\text{V}}\text{C}_2^{\text{VI}}$ crystals and $(\text{A}^{\text{III}}\text{B}^{\text{V}}\text{C}_2^{\text{VI}})_{1-x}(\text{2A}^{\text{IV}}\text{B}^{\text{VI}})_x$ solid solutions, in particular under extreme conditions (high hydrostatic pressures of ~ 300 kbar and low temperatures of ~ 0.05 K). As a result of these studies, the basic kinetic parameters and the model (shape) of the charge carrier bands for these semiconductors have been first determined.

Of primary concern are the results of Prof. Popovich in the study of the specific features of heat transfer and the thermoelectric efficiency of $(\text{A}^{\text{III}}\text{B}^{\text{V}}\text{C}_2^{\text{VI}})_{1-x}(\text{2A}^{\text{IV}}\text{B}^{\text{VI}})_x$ solid solutions. In studies of the $(\text{TlBiS}_2)_{1-x}(\text{2PbS})_x$ system, Prof. Popovici found that the thermal conductivity of the lattice of these alloys achieves extremely low values ($K_L \sim 0.26$ W/mK), which almost achieves the lower limit of parameter K_L theoretically determined for crystalline semiconductors, and, therefore, leads to a significant increase in thermoelectric efficiency Z in these materials. The new systems of $(\text{A}^{\text{III}}\text{B}^{\text{V}}\text{C}_2^{\text{VI}})_{1-x}(\text{2A}^{\text{IV}}\text{B}^{\text{VI}})_x$ solid solutions discovered by Prof. Popovici open the way to the implementation of a new strategy in the field of engineering of thermoelectric materials.

It should be noted that a large portion of the research of Prof. Popovici were completed with specific developments, which were protected by patents and subsequently implemented in actual practice in various research centers and specialized technical offices. These developments include TlSbSe_2 temperature-sensitive resistors; Au-n-TlSbSe_2 broadband diodes ($0.6\text{--}1.4\ \mu\text{m}$); TlSbS_2 photoresistors ($\tau \sim 10^{-8}$ s, $\rho_d/\rho_f \sim 10^7$, $I \sim 10^{25}$ photon/cm² s) for the generation of giant ruby laser pulses; a device for measuring the electric conductivity and thermopower of semiconductor materials in a temperature range of $300\text{--}1200$ K; and a device for measuring the thermal conductivity of thermoelectric materials using the Peltier effect.

The results of Prof. Popovici have been appreciated by experts in the field. This is confirmed by the fact that, in recent years, he was repeatedly invited to the United States (Ferrotec Corporation) as scientific consultant in the field of engineering of thermoelectric materials.

Professor Nicolae Popovici has made a considerable contribution to the training of highly skilled scientific personnel. He was a research supervisor of seven doctors in physics and mathematics.

In 1969–1972, N. Popovich worked as a lecturer at the Department of Physics at the Ion Creanga Pedagogical University and the Department of Physics at the N. Testemitanu University of Medicine and Pharmacy. He delivered lectures on physics and engineering of semiconductor materials and energy-converting electronic devices and master class courses at the Technical University of Moldova (1977–1985), Tiraspol University located in Chisinau (2003–2009), and Al. Russo State University of Balti (2006).

Professor Nicolae Popovici will be remembered by his disciples and colleagues as a recognized expert in condensed matter physics and a highly skilled specialist in semiconductor material technology.

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