Nanotechnology – challenges and opportunities for businesses

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Institute of Physics Polish Academy of Sciences is the leading research institute in Poland with range of molecular beam epitaxy (MBE) and atomic layer deposition (ALD) reactors used to grow semiconducting, isolating and metallic nano-materials. Thus, in first part of my presentation I will shortly introduce nanotechnology-related activities in the Institute of Physics. Then, I will describe recent investigations of oxide materials grown by Atomic Layer Deposition and also microwave-driven hydrothermal method.

Technique of Atomic Layer Deposition (ALD) was introduced in Finland in 70ties of XX century. A real breakthrough came with the use of ALD by Intel company for deposition of gate oxides in new generations of integrated circuits. At present ALD is widely used both in the research and in industry for deposition of a wide range of different materials.

Principles of the ALD will be first shortly described. Then, I will describe activities of the ALD laboratory in the Institute of Physics, PAS in Warsaw. Use of the ALD allows us deposition of a range of oxides materials at exceptionally low temperature on different substrates, including polymers, paper, glass, and with different surface topography – flat or 3D-like. Several examples will be given how advantageous properties of the ALD allows us to grow materials with different properties and prepare several demonstrators of devices for applications in electronics, including transparent electronics, optoelectronics, spintronics, photovoltaics.

Recently, we also demonstrated new applications of selected oxides – applications in biology and medicine.