S1-P.44
Excitonic Crystal in Nanotechnology

S. Pyshkin
Institute of Applied Sciences, Chisinau, Republic of Moldova

This paper demonstrates the results of development of growth technology for perfect and free of contamination gallium phosphide (GaP) crystals and investigation of influence of crystallization conditions on quality and properties of the crystals. The long-term ordered and therefore close to ideal crystals repeat behavior of the best nanoparticles with pronounced quantum confinement effect. These perfect crystals are useful for application in top-quality optoelectronic devices as well as they are a new object for development of fundamentals of solid state physics.

Since the time of original preparation by the author in the 1960s of gallium phosphide crystals doped by nitrogen (GaP:N), followed by the introduction of the excitonic crystal concept in the 1970s, the best methods of bulk, film and nanoparticle crystal growth were elaborated. The results of the semi centennial evolution of GaP:N properties are compiled in the paper. Novel and useful properties of perfect GaP including its stimulated emission, very bright and broadband luminescence at room temperature were observed. These results provide a new approach to selection and preparation of perfect materials for optoelectronics and a unique opportunity to realize a new form of solid-state host - the excitonic crystal as high intensity light source with expected low threshold for generation of non-linear optical effects.

Using the example of GaP, here is proposed the cheap, resource-saving and impactful way for development of optoelectronics with the help of a special transformation of an ordinary semiconductor into the base material for various device structures.