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NITRIDE SEMICONDUCTORS – PROPERTIES AND APPLICATIONS

Why are the III-nitride semiconductors so unique that they became the second most important semiconductor material after silicon? Why it was so difficult to prepare high quality nitride layers? It was so difficult that scientist, which have partly solved this problem were five years ago awarded by Nobel Prize. What are the most perspective applications for nitrides? What problems have to be solved in nitride technology? Answers to these four questions concerning nitride properties, applications, technology and open problems will be presented in our contribution. We will show how the piezoelectric field in nitride heterostructures can be utilized in transistors with high electron mobility, but on the other how it can complicate the carrier confinement in quantum wells and design of optoelectronic applications. Application in lasers and light emitting diodes, in high electron mobility transistors (HEMTs) and in scintillators will be discussed with their advantages and limitations. We will touch also the most important technological problems and challenges, such as high dislocation density and possible ways to suppress it, the p-type doping of AlGa_N layers, problems with limited indium atom incorporation. Results of scintillator structure development in our group with the world record InGa_N QW number will be presented.

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