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**Epitaxial Growth: Novel Materials, Quality, Defect Creation, X-ray Diffraction Characterization**

This lecture will demonstrate contemporary epitaxial growth techniques as Molecular Beam Epitaxy (MBE) and Metal-Organic Chemical Vapor Deposition (MOCVD) for epitaxial growth of high quality materials for different opto-microelectronic applications. Epitaxial methods, specific technological area, demonstrate new possibilities in creation of novel high-crystal quality materials, including Quantum Wells (QW) and Quantum Dots (QD) physical objects; in general, impossible by other physical or chemical methods.

One of the main topics related to epitaxial growth, is a creation of crystal defects: very complicated multistage process, significantly affecting crystal perfection of epitaxial structures and device properties, will be carefully considered. A model of defect creation, recently developed, correctly described accommodation procedure in different epitaxial structures, including Si-Ge, cubic III-V and highly lattice mismatched III-Nitride compounds, will be discussed in details. Recent result of structural investigations of crystal perfect III-Nitride compounds grown by MBE with unique laser ignited plasma source will be demonstrated and discussed in details. Important applications of epitaxial structures, as semiconductor lasers with QWs or QDs active area, nano-lasers and thin-film solar cell converters will be considered as well.

X-ray diffraction, one of the most powerful characterization tools in material science will be presented; x-ray diffraction application to different structural objects, mostly focusing on high-resolution investigation of epitaxial structures, including quantum well and nano-sized structural objects, will be demonstrated and discussed as well. Extremely high sensitivity of x-ray diffraction to crystal defects allows specify defect creation in epitaxial structures in details, including types, density and spatial distribution in the volume of epitaxial structure. The main characterization features of high-resolution x-ray diffraction and Transmission Electron Microscopy and Atomic Force Microscopy for investigation of epitaxial structures will be compared.