



中国科学院  
固体物理研究所

## 学术报告(2015.9.18)

**Title:** Orientation driven ordering and composition fluctuation in nitride semiconductors alloys

**Lecturer:** Prof. Pierre RUTERANA, Director of Research CNRS

**Time:** 2:30PM, Friday, September 18, 2015

**Place:** Room 520, New Building of Institute of Solid State Physics

### Abstract

The nitride alloys (In,Al,Ga)N have turned out to constitute theoretically one semiconductor family of materials that cover the largest part of the wavelength spectrum for numerous optoelectronic applications including efficient light emission. Nowadays, the light emitting diodes and laser diodes which operate in the Blue/UV range probably are one of the most efficient ways to convert electricity into light. An extremely intense worldwide research has permitted to have white lamps for solid state lighting with more than 100 lm/watt in production, 200 lm/Watt in the development stage and past 300 lm/watt at the research stage. In addition, important efforts are made in order to obtain efficient emitters towards the visible as well as in the UV. However, many challenges lie still across the development of highest efficiency devices: 1) AlN, GaN and InN grow highly different temperatures, at about 500 (InN) and can be more than 1000°C (AlN, GaN), respectively; 2) for the heteroepitaxy, lattice mismatches are quite important for instance: 11% between GaN and InN, 3.5% for (AlN, GaN) and 13.7 between InN and AlN, on the (0001) surface whereas other orientations allow to avoid polarization effects which are inherent to the wurtzite structure. 3) During the growth of the alloys, ordering, phase separation and formation of extended defects may take place due to the large differences in atomic radii in GaN and InN. In this talk, we shall discuss the different possibilities that have been pointed out during the growth of InGaN, InAlN and AlGaN alloys through MOVPE and MBE. Our investigations combine the transmission electron microscopy analysis down to atomic scale and modeling which are to be correlated with the device performances.

### Resume

Prof. Pierre Ruterana is the Director of Research in CNRS (the French National Centre for Research) and the Head of the Research TEAM "Properties of materials for energy savings" PM2E in Laboratory CIPAM (Centre de Recherches sur les Matériaux, les ions et la Photonique). Prof. Ruterana is a specialist in quantitative high resolution electron microscopy with applications to numerous materials including semiconductors, ceramics, catalysts and nanomaterials. He has contributed to more than 300 scientific publications in peer reviewed journals, and delivered more than 70 invited talks at international conferences. Up to now, he has been the principal organizer of more than 15 workshops and/or symposia at international conferences.

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