PROFESSOR NAKAMURA MET LED RESEARCHERS AT MICRONOVA

Millennium Technology Prize winner Professor Shuji Nakamura visited Micronova September 12th, 2006. Professor Nakamura met with Professor Harri Lipsanen and his research group as well as Vice President Jussi Tuovinen from VTT.

In the beginning of the visit Professor Nakamura gave a lecture about new technology based on gallium nitride technique. This would give the Third World countries an opportunity to use sun light for wireless energy made possible by gallium nitrides.

– Already developed applications show that with GaN based LED technology it is possible to significantly reduce energy consumption worldwide, says Professor Nakamura.

– Gallium nitride based LEDs make it possible to produce environmentally friendly and energy efficiency lightning to the Thirld World countries, decontaminate drinking water more efficiently and cheaply as well as it helps to store data much better than before.

Professor Nakamura also shared a vision about gallium nitride as a solution for the production of hydrogen for fuel by photocatalysis of water. Gallium nitride is able to store sunlight energy with the help of quantum well structure, and so no electricity at all will be needed for the splitting of water.

The only GaN researchers of Finland are working at Micronova

Professor Harri Lipsanen from the Laboratory of Micro and Nano Sciences told for his part how his research group has managed to develop a technique which makes it possible to significantly reduce the amount of crystal defects which affect the brightness of the LEDs.

Professor Lipsanen is the first professor of nanotechnology in Finland (year 1999) and he was only just chosen to be the Finnish person in charge of a programme called Photonic Integrated Circuits by Heterogeneous Integration for Telecommunication and Sensor Applications (2007–2011). The programme is part of the Finland Distinguished Professor Programme (FiDiPro) of Tekes (Finnish Funding Agency for Technology and Innovation).

– The light of the LEDs and lasers are produced inside the 2–3 nanometers thick layers (this is only about 10 atomic layers) which are called quantum wells. The colour of the output light is controlled by the amount of indium added to the gallium nitride in these wells. This new technique has also clearly improved the quality of quantum wells, says Professor Lipsanen.

The Laboratory of Micro and Nano Sciences of Helsinki University of Technology (TKK) situated at Micronova, has researched and produced compound semiconductor structures which have been used in optoelectronics components for more than 20 years. The research group has developed for example the first semiconductor lasers of Finland and unique quantum dot and nanowire stuctures for nanotechnology.

Among the equipment at the Laboratory of Micro and Nano Sciences are Finland's only MOCVD facilities which are also used by Professor Shuji Nakamura for the production of GaN-based LEDs and lasers.

The fabrication of visible (blue, green and white) LEDs is started by making GaN based layers of atomic layer accuracy on the top of the sapphire discs using the MOCVD method. However, on the microscopic level there are lots of crystal defects which decrease the brightness of the LEDs. The research group has managed significantly decrease the amount of these defects by the technique they developed.

During the last three years the Laboratory of Micro and Nano Sciences has in close co-operation with a start up company OptoGaN developed innovatory methods to increase brightness of the GaN-based LEDs and lasers. OptoGaN has already started GaN industry in Finland.

The LED research at VTT

VTT (Technical Research Centre of Finland) has a broad LED-related research complex in the research programme for printed intelligence. They develop organic large displays (OLED).
– With this method it is possible to produce cheap large LED-displays and smart packs, Vice President Jussi Tuovinen from VTT said.

LED technology has been utilised in the production of array spectrometers for materials research in the infrared area. This method has been applied to industrially required process measurements eg. measuring the texture and quality of food. In the future, the LEDs in the ultraviolet area produced by professor Nakamura will also be used in the spectrometers. This technology can be applied for example to the measurements needed by the pharmaceutical industry.

For more information:

Professor Harri Lipsanen
Laboratory of Micro and Nanotechnology, TKK
harri.lipsanen@tkk.fi
tel. +358 9 451 3123

Vice-president Jussi Tuovinen
VTT
jussi.tuovinen@vtt.fi
tel. +358 20 722 6508