

Ph.D. Course in Materials Science and Nanotechnology

University of Milano-Bicocca, Department of Materials Science, via Cozzi 55, 20125 Milano

May 21, 2018 – 2.30 p.m.
Building U3 – room 06

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Novel Epitaxial Growth Methods for Nitride Materials with Using Plasma Technology

For nitride semiconductors, MOCVD and MBE methods are conventionally applied for their crystal growth. These methods however several disadvantages for industrial production point of view so that we are developing new methods, by using plasma technology which is based on our long time experience.

In the case of MBE, nitrides are grown using nitrogen radical source based on ICP (induced coupled plasma) but the growth rate is small so that this method is limited only for research purposes. We have therefore developed a novel radical source which is based on ICP and CCP (capacitance coupled plasma) in order to increase the density of atomic nitrogen radicals. By using this novel high density radical source (HDRS), it was proved that high quality GaN and InGaN epitaxial layers can be grown with higher growth rate than conventional radical sources.

In the case of MOCVD, a lot of ammonia gas is used, more than several thousand times more than that necessary. This is because stable ammonia has to be thermally excited but the efficiency is very small. Therefore, ammonia cost takes a large part of the total cost which makes difficult to decrease the power device cost. Since high temperature is necessary, growth on large diameter wafers makes wafer breakage and bowing due to thermal expansion coefficient. We have therefore developed a novel REMOCVD method, in which nitrogen and hydrogen gas are plasma treated and nitrides can be grown by the reaction between radicals and MO gas. In fact, it was proved that GaN, AlN and AlInN can be grown with high crystal quality at lower temperatures than those for MOCVD. High quality InN can be grown even at a temperature as low as 200°C.

Web site: <http://www.plasma.engg.nagoya-u.ac.jp/>

PhD students and all interested in the seminar are kindly invited to participate.

The PhD Coordinator
Prof. Marco Bernasconi