



Physical Research Laboratory, Ahmedabad

COLLOQUIUM - 13 – 11

Speaker: Dr. M. D. Sastry

Head, R&D, Gemmological Institute of India (GII), Mumbai.

Title: Colourful Story of Diamond: A Journey from Crown Jewel to Quantum Information Processing – Role of Spectroscopy of point defects.

Abstract

Diamond with a sp^3 hybridized Carbon having tetrahedral structure, is a well known gem stone with many interesting physical properties. It is the hardest material with highest thermal conductivity and also has very high Debye temperature (2200K) resulting in low vibrational density of states. In general, with an exception of nitrogen and hydrogen to a lesser extent, diamond does not contain chemical impurities. Diamonds with undetectable amounts of nitrogen are classified as type IIa and those with detectable amounts of nitrogen are classified as type Ia or Ib depending on the type of nitrogen aggregation. Among these, type Ia is the most commonly occurring form (~ 98%). Both type Ia and IIa type diamonds are colorless, and type Ib with isolated nitrogen impurity has a yellow color. Colouration can be induced and manipulated by electron beam treatment (EBT) followed by a thermal cycling. It is possible to produce attractive blue, pink and cognac colors by EBT and heat treatments. These colours are due to the stabilization of point defects consisting of a variety of nitrogen-vacancy complexes. Among these, negatively charged NV complex with zero phonon line at 637 nm has been found to be suitable for quantum information processing (QIP) at room temperature. It has been experimentally established that apart from NV- centre, centers such as SiV- and a nickel complex, termed as NE8, are also suitable as single photon emitters at room temperature and can be used for quantum information processing. The feasibility of quantum computation at room temperature using a highly stable material with optically and thermally stable centres holds a great promise for a practical quantum computer. The relevant aspects will be presented.

The Speaker

Dr M. D. Sastry obtained his PhD in physics from Indian Institute of Technology, Kanpur in 1968. After Postdoctoral research experience in Canada and UK, he joined the Bhabha Atomic Research Centre in 1973. He worked in BARC for nearly 30 years and superannuated as Head of the Spectroscopy Section, Radiochemistry Division. He has wide experience in the spectroscopy of metal ions and radiation induced defects in solids using Electron Paramagnetic Resonance, electronic absorption and luminescence techniques. He worked as a visiting Professor in USA, Sweden, Brazil and PRL - Ahmedabad. During the last six years Dr Sastry and his colleagues developed spectroscopic methodology at GII for gem/diamond testing using laser micro Raman, Laser Induced Breakdown Spectroscopy, FT-IR, UV-Visible absorption and Photo Luminescence. He authored nearly two hundred papers in peer reviewed national and International journals and was the President of the Luminescence Society of India.

Wednesday: 13 March, 2013, 16:00 hrs.

K.R. Ramanathan Auditorium, PRL

Tea at 15:30 hrs

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