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Indian R&D in Luminescence and its Applications: Where Do We Go from Here?

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The year 2015 is very special for the researchers working in the field of light and its applications. The year is being celebrated as the International Year of Light (IYL-2015) to raise awareness of optical technologies in providing solutions to the diversified challenges, i.e., energy, education, agriculture, environment, communication and health, and thereby contributing to the sustainable development on this globe. Historically, luminescence and its applications have been one of the main drivers of new light sources and light based devices, and they together form a large body of the optical technologies as we see them today. It is on the backdrop of IYL-2015, we need to discuss the growth of the field of luminescence and its applications in Indian context.

While the study of luminescence in India started sometime around 1920, the first organized research activity can be credited to C.V. Raman and his school at Bangalore. During 1930s and 1940s, his school made several fundamental contributions to the luminescence of diamond including its thermo-luminescence. Work on luminescence of uranyl ion initiated by D.D. Pant and continued in later years was also a significant development that made the home grown research worthy of international appreciation. In 1960s the field of luminescence in India was impacted greatly by two concurrent requirements: firstly the need for radiation dosimetry in the Indian nuclear energy programme [1] and secondly the growing activity in the country in archaeological and geological dating [2]. The thermo-luminescence dosimetry in the fold of Department of Atomic Energy experienced an exponential growth through development of new phosphors and dosimetry techniques, and they have been exploited in different areas such as personal and environmental monitoring, medical dosimetry, high dose dosimetry as well as accidental and retrospective dosimetry. These dosimetry techniques have been routinely used in the measurement of environmental radiation monitoring in and around nuclear installations and accelerators, personal monitoring of radiation workers, medical physics and also in monitoring the external radiation exposure in high natural background radiation areas. The field is mature today with the advent of several new developments which include thermal/fast neutron dosimetry, charged particle dosimetry, optically stimulated luminescence (OSL) dosimetry so on so forth. Luminescence based archaeological and geological dating began at IIT Kharagpur around 1967. A dedicated luminescence geochronology programme was established at Physical Research Laboratory. Today the field is pursued by a number of other institutes/universities, e.g., Manipur University, Geological Survey of India, National Geophysical Research Institute, Wadia Institute of Himalayan Studies, Institute of Seismological Research etc. While the radiation dosimetry and archaeological/geological dating provided the two main streams of R&D in luminescence, the third stream was developed in the universities [3], notably, IIT(Kharagpur), IIT (Madras), MSU (Baroda), NPL (New Delhi), RTMU (Nagpur), PtRSU (Raipur) etc. This stream has been successful in synthesis and characterization of new phosphor materials and also in applications of luminescence in areas other than radiation or geological dating. Luminescence Society of India (LSI) has been providing an umbrella for these three streams of research in luminescence and applications. About 150 papers are presented in the annual conference of LSI and the number is as high as 400 during its international conference. I understand that more than 4000 papers have been contributed by the researchers so far in these conferences.

There are two pertinent questions which we need to discuss at this stage. The first is related to the growth of the field and newer avenues for the same. I would like to quote here B.R. Judd [4]– '*What about the future?..... If the future presents no more than a natural extension of the past, the field would be dull indeed. Its continued vitality must rest on the expectation of at least the hope that things are never as simple as they appear at first sight and that the surprises will continually occur...*'. These surprises may lie beyond the well traded path and the community needs to on the lookout for these surprises continuously. For example, laser induced fluorescence can provide a window to the understanding of microscopic world and the usual laws governing emission can be defied in nano-photonic assemblies [5].

The second question is related to the inherent strength of the field which makes it useful for applications and technology development. Historically, the field of luminescence grew due to its intimate connection with fluorescent lamps, cathode ray tubes, TV screens, lasers,

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semiconductor devices, flexible displays etc. etc. Newer applications of luminescent materials have fuelled the growth of the subject in the international context. The beginning of nuclear energy programme in the country indeed provided the necessary impetus to the development of thermo-luminescence dosimetry. The field today needs a small or big technological idea, which can help to grow the field further.

The message of the Year of Light 2015 is loud and clear. It is a celebration of optical technologies that have changed our lives. We cannot be mute spectators or followers in the advancements that have happened and are happening around us.

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