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Nanotechnology TLD and OSLD Nanophosphors

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High-energy radiations (also known as ionizing radiations), in the range from UV, X-rays to nuclear radiations, such as α, β, γ rays and neutrons or swift heavy ions (SHI) are hazardous to living beings. It is not natural radioactivity and natural radioactive materials that emit such radiations that are hazardous but the man-made machines for diagnostic purposes and nuclear reactors and the nuclear waste is a greater threat. The radiation from nuclear weapons of mass destruction is a threat during war times. The atomic bombing on Hiroshima and Nagasaki is a classic example. Chernobyl accident in Russia and recent one at Fukushima in Japan shows that the danger not only to human beings but to the whole nature. Therefore, such high-energy radiations need to be monitored and shielded properly to avert any further threat. There are several techniques for radiation monitoring, such as, gas filled detectors, scintillator counters, streak cameras, semiconductor detectors and so on. But most of these detectors come with electronic gadgets and not very convenient to work with. Thermally and optically stimulated luminescent detectors (TLDs and OSLDs) are very tiny and easy to use detectors. They are very popular to be used as badges, I cards, neckless or ring or in any other form and are being used for several decades now. But no detector or technology is perfect. It was found that most of the commercially available TLD phosphors are at disadvantage due to thermal stimulation for their readouts. For example, $CaSO_4$:Dy (TLD-900) change its glow curve structure at high doses and on annealing at high temperatures, LiF:Mg, Cu, P loses its reusability if heated above 523 K due to redox reactions of Cu, CaF_2:Mn also loses its reusability by heating due to clustering of the heavily doped Mn impurity. Moreover, the saturation of the thermoluminescence intensity at high doses prohibits its application where there is a need to monitor them. For example, radiotherapy of cancer patients, sterilization of blood and food items, packaging and storage of ready to eat food, etc. TLD/OSLD nanophosphors are found to have very wide range of dose response and could be employed for this purpose. Not only are they useful for this purpose but miniaturizing of single crystal/microcrystalline forms have revealed more insides and paved ways for improvement. In the present review, the synthesis, characterization dosimetric characteristics of these nanomaterials are discussed.

Biography

P D Sahare has completed his PhD from Nagpur University and Postdoctoral studies from Department of Polymer Science & Engineering, University of Massachusetts. He is presently working as Professor of Physics at the University of Delhi. He has also been recently appointed as Radiation Safety Officer at his institution. He has published more than 100 papers in reputed journals and serving as Editor-in-Chief and also an Editorial Board Member of some journals of repute. His research interests are radiation luminescence dosimetry, Catalysts for waste water purification, optical gas detectors, mesoporous nanoparticles, wide band semiconducting nanomaterials, etc.

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