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Nanosensors for Dosimetry of Therapeutic Levels of Ionizing Radiation

Radiotherapy is a common medical procedure, especially for the treatment of cancers such as head and neck, breast prostate, lung and rectum. It is a complex process aimed at maximizing delivery of the planned dose to the tumor sites while minimizing unnecessary radiation to healthy tissues. Today, radiotherapy procedures make use of image guidance and intensity modulation for better treatment as well as commercial dosimeters for dose verification. Commercial dosimeters are also employed in other applications where sensing ionizing radiation is of interest such as defense and other military, environmental and agricultural applications. However, these sensors are often expensive, difficult to handle, invasive and require post processing facilities.

Researchers at Arizona State University in collaboration with colleagues at Banner MD Anderson have developed easy to use calorimetric-based radiation dosimeters that detect low doses of ionizing radiation. This low-cost dosimeters can detect low doses, in the range of 1-10 Gy, of ionizing radiation. The color change in these dosimeters can be easily observed by the naked eye, and quantified by optical readout. These devices can be easily employed within containers of different sizes and shapes to suit different needs, e.g. one has been deployed inside an endorectal balloon to quantify the dose received by the rectal wall. A device is encapsulated in materials such that the sensor can render spatial information regarding the points where radiation has occurred.

The ability of these devices to measure low doses, combined with their ease in preparation and physical characteristics makes them attractive candidates for in vitro/vivo dosimetry during radiotherapy, military and other applications where sensing ionizing radiation is of interest.

Potential Applications

- Radiation Dosimeter
  - Radiotherapy dose verification
  - Defense/military
  - Environmental and agricultural sectors

Benefits and Advantages

- Can detect low doses of ionizing radiation (1-10 Gy)
- Can work at room temperature without any requirement of sophisticated processing facilities
- Can also work at slightly elevated temperatures such as physiological temperatures
- Optical readout is an easy measurement technique
- Color change acts as a quick "yes/no" indication of presence of radiation
- Custom shape/size - can be molded/packed in different containers for in vitro/in vivo applications
- Low cost
- Can provide spatial dose distribution

For more information about the inventor(s) and their research, please see Dr. Rege's directory webpage