ADA Science & Research Institute

Carbonated Hydroxyapatite Radiation Dosimeters

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Inventors

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Background

Radiation dosimeters are devices used to measure exposure to ionizing radiation such as X-rays, alpha and beta particles, and gamma rays. The damage that this radiation can cause to a material (e.g., human tissue) is typically cumulative, related to the total ionizing dose received. Therefore, individuals who are exposed to ionizing radiation are usually required to carry a dosimeter. A variety of different dosimeters exist, including film badges, thermo-luminescent dosimeters, solid state devices and alanine dosimeters. However, these may require destructive testing, have limited measurement ranges, must be periodically calibrated and/or require expensive processing. Consequently, more than one device type may need to be used together.

Invention Description

To address these issues, the inventors have developed bio-inspired dosimetry materials by synthesizing carbonated hydroxyapatite cements (CHCs) using a self-setting reaction of self-hardening calcium phosphate cements (CPCs). The synthesis method allows precise control of the composition, impurity incorporation, and crystallinity of the cement. The materials produce stable electron paramagnetic resonance (EPR) signals after exposure to ionizing radiation, with the signal proportional to the irradiation dose.

Intellectual Property Status:

US patents issued:
US 10,509,092 B2
US 10,545,214 B2

Potential Applications

The materials may be used in biological and industrial dosimetry applications including:

- Personal dosimeters for healthcare workers
- Patient radiation treatment and radiation therapy monitoring
- Personal dosimeters for civil accident and military battlefield
- Nuclear power stations and nuclear waste cleanup
- Calibration standards or reference sources for EPR dosimetry systems
- Industrial/medical supplies/food irradiation measurements

Benefits and Advantages

- Low cost – simple material preparation is highly reproducible and requires no fillers or binders, and no microelectronics processing
- Self-setting CPC method allows precise and tailorable compositional control
- Non-destructive testing – EPR measurements allow continuous use
- Material stability & higher accuracy – less sensitive to environmental factors than alanine
- Potential to increase the measurement range – one device may cover ranges that presently require use of more than one device type

Contact

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