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Investigation of silica-based TL media for diagnostic x-ray dosimetry (Article)

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Abstract

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We focus on the development of Ge-doped silica thermoluminescent dosimeters with sensitivity superior to that of the LiF (Mg,Ti) phosphors popularly used in x-ray diagnostic imaging dosimetry, the latter typically being referred to through use of the product identifier TLD-100. Of interest are Ge-doped silica telecommunication fibres (SMF) and tailor-made doped photonic crystal fibres (PCFc), the latter Ge-doped or also co-doped with boron. The PCFs are formed of capillaries that at high temperatures and under vacuum are made to collapse inwards (PCFc), the internal walls fusing and generating strain-related defects. To-date, the fabricated SMF, PCFc-Ge and PCFc-Ge-B have been observed to provide TL yields which weight-for-weight are some 2, 10 and 15x that of TLD-100. In present study we test the linearity of TL yield for x-ray doses from 0.1- to 10 mGy, use being made of an x-ray tube operated at 80 kVp, an operating potential typically selected in chest radiography. For a dose of 10 mGy, a study of energy dependence has been conducted using x-ray tube potentials of 80 kVp 100 kVp, and 120 kVp, with inherent filtration 0.9 mm Al measured at 75 kVp, and total filtration of 2.8 mm Al at 80 kVp. © 2017 Elsevier Ltd

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Author keywords

Chest imaging | Dosimetry | Ge-doped silica | Thermoluminescence photonic crystal fibre | TLD

Indexed keywords

Engineering controlled terms: Aluminum | Crystal whiskers | Dosimetry | Germanium | Photonic crystal fibers | Photonic crystals | Silica | X-ray tubes

Compendex keywords: Chest imaging | Chest radiography | Energy dependence | Ge-doped silica | High temperature | Internal walls | Thermoluminescent dosimeters | X-ray diagnostics

Engineering main heading: X-ray radiography

EMTREE drug terms: boron | germanium | glass fiber | lithium fluoride | magnesium | photonic crystal fiber | silicon dioxide | titanium | unclassified drug

EMTREE medical terms: Article | diagnostic imaging | diagnostic value | dosimetry | energy yield | irradiation | radiation dose | radiodiagnosis | radiosensitivity | temperature | thermoluminescence dosimeter | thorax radiography

Chemicals and CAS Registry Numbers:

boron, 7440-42-8; germanium, 7440-56-4; lithium fluoride, 7789-24-4; magnesium, 7439-95-4; silicon dioxide, 10279-57-9, 14464-46-1, 14808-60-7, 15468-32-3, 60676-86-0, 7631-86-9; titanium, 7440-32-6

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