Characterization of amorphous thermoluminescence dosimeters for patient dose measurement in X-ray diagnostic procedures

ABSTRACT

We investigate the use of novel Ge-doped amorphous silica flat fibers as thermoluminescence dosimeters (TLDs) in verifying patient entrance surface-dose (ESD) in diagnostic examinations. Selected fibers with established dosimetric characteristics (including energy dependence, linearity, reproducibility, and fading) were loaded into plastic capsules in groups of six. The fibers have been calibrated against a parallel plate ionization chamber, use being made of x-rays generated at 70 kVp, accessing a Secondary Standards Dosimetry Laboratory (SSDL) facility. The fiber characterization measurements were made using a Toshiba X-ray machine operating within the nominal energies range 40 kVp to 150 kVp, for doses in the range 0.02 mGy up to 3 mGy. For doses from 2 mGy up to 150 mGy, the flat fibers exhibit linearity between TL yield and dose, reproducible to better than 3% standard deviation following repeat measurements (n¼3). A marked energy-dependent response is observed for photons generated at potentials from 40 kVp to 150 kVp. From present results, it is concluded that Ge-doped fibers represent a viable system for use in diagnostic dosimetry, corrections being made for the various factors influencing TL yield.

Keyword: Dosimetric characteristics; Amorphous Lithium fluoride; Luminescence