

Application of superlinearity correction factor in TL dose calibration for evaluation of output dose; LiF:Mg,Ti TLD

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Purpose: To get an accurate dose evaluation in therapeutic radiation dose measurement and intercomparison the output dose using the thermoluminescent dosimetry, superlinearity and decay constant were investigated for dose corrections.

Methods: The 200 mesh of LiF:Mg,Ti (Teledyne, U.S.A.) TL powder was investigated the superlinearity and decay constant against the exposure dose of 6 MV X rays. The exposure doses were ranged from 1 to 20 Gy for investigation of TL superlinearity in linear accelerator x-ray beam.

The TL reader (System 310, Teledyne) was operated in program for heating rate 14.5 degrees/sec for preheating first 10 sec, isothermal heating for 20 seconds and 15.0 degrees/sec from 30 to 45 seconds, respectively. When the reader is operating in experimental status, the TL reader was performed calibration for sensitivity corrections with sample which LiF-700 chips were exposed to Cs-137 source present activity of 1.7 Ci.

Results: The heating rate include the preheating created two TL peaks at 130 and 270 degrees in glow curves of which main peak showed at 270 degrees in this experiments. The ratio of first glow peak to second peak has showed the stable index of exposure time as the different decay response. The superlinearity of LiF:Mg,Ti powder reveals from 3 Gy and the ratio of TL dose to given output dose showed as 1.08, 1.22 and 1.46 for response of TL for 500, 1000 and 20 Gy in same operating protocol for TL reader system, respectively. The decay constant reveals the 0.99 for 10 days, 0.97 for one month and 0.95 for two months elapsed time. The decay correction factor is adapted to dose correction of TL dosimetry against the duration of delivery time. The output measurement of exposed sample powder in arbitrary dose evaluated within 1 % uncertainty in clinical range 100-500 cGy.

Conclusion: The TLD powder is small limitation of booking list for dose measurement, however the TL glow peak and shape is very high dependent to heating rate, stable reader condition and thermoluminescent material. The superlinearity of LiF:Mg,Ti powder and decay correction factor should be applied to build up the protocol of dose measurement in clinical range.