

How Does Thermo Luminescent Dosimeter Work



Ionizing radiation presents an invisible form of health hazard to users of radioactive substances and irradiating apparatus. Although the common radiation quantity encountered in an academic setting is usually relatively low, the cumulative effects could be significant. Therefore personal protective equipment must be used, and exposure monitoring performed, to ensure the safety of radiation workers.

Thermo luminescent Dosimetry (TLD) is the primary form of personnel radiation exposure monitoring used at HKUST. There are almost two hundred radiation workers on campus wearing these blue plastic badges.

What is TLD

Thermo luminescent (TL) means emitting light when heated. We can briefly describe the mechanism of TL as follow:

When a strong energy source (such as ionizing radiation) hits a TL material, electrons are freed from some atoms and moved to other parts of the material, leaving behind "holes" of positive charge. Subsequently when the TL material is heated, the electrons and the "holes" re-combine, and release the extra energy in the form of light. The light intensity can be measured, and related to the amount of energy initially absorbed through exposure to the energy source.

The blue box issued to radiation workers is a plastic casing that holds a sheet of TL material used as a dosimeter (i.e. TLD), and some metal foil to filter the radiation to be recorded. After the designated monitoring period, the TLD is collected and read by a TLD Reader which can heat up the TLD, detect the resulting light emission, and calculate the radiation exposure to the person wearing that particular TLD. The TLD may be reused after a controlled heating procedure which completely recombines all "electron-hole" pairs, and restores the TLD to the original condition.

Keep in mind that, these TLD in blue boxes:

- ARE NOT radioactive themselves
- DO NOT protect wearer against radiation
- DO measure the amount of strong B, alpha , and X-, radiation exposure of the wearer, if used properly.

The TLD services at HKUST

SEPO administers the HK Government Department of Health TLD service for the HKUST campus. Laboratory workers registered with SEPO as radiation workers receive their TLD at the beginning of each month through SEPO, at which time they are to return the TLD for the previous month, again through SEPO, for reading. Monitoring reports for the month before last is provided with the replacement TLDS.

Finger TLD

Finger TLD is one form of extremity dosimetry, in contrast with the common whole body TLD described above. Finger TLD measures the radiation exposure of worker's hands by a special ring or strip containing a small TLD.

Many times when radioactive materials are used in bench-top experiments, the body trunk of the experimenter is protected by the bench and/or specialized shields, while the hands are directly exposed to radiation during experiments. In these cases, the whole body dosimetry does not reflect the exposure of the worker's hands, which are presumably most exposed to radiation. Finger TLD will give a true measurement of exposure for this part of a workers' body.

This particular type of dosimetry is not available from the Government Department of Health, but is widely employed in foreign countries. Therefore, SEPO has retained the service of an outside consultant to develop a finger TLD program tailored for HKUST radiation workers. Details of this supplementary program will be announced in the near future.

Teminder for TLD Users

A user must wear a dosimeter issued to him as indicated on the dosimeter label. Under no circumstances shall a dosimeter issued to a specific wearer be worn by another person.

- The user must wear the dosimeter all the time when performing radiation work.
- The dosimeter must be worn near the center of the wearer's trunk, with the front window of the holder facing outward.

- The user must keep the dosimeter away from the radiation work area when not performing radiation work.
- Never remove the dosimeter from its Polythene pouch.
- Never wear a dosimeter without a dosimeter holder.
- Never use a dosimeter holder which has an incomplete set of filters.
- Never lag behind the schedule on the return of dosimeters for analysis.

(Adopted from "Instruction on the use of TLD personnel radiation monitoring dosimeters" issued by Radiation Monitoring Service, Department of Health, Hong Kong Government, and appeared on the August/1995 issue of Safety Wise.)