DOSE REASSESSMENT METHOD IN THERMOLUMINESCENT DOSIMETRY BY USING THE PTTL PHENOMENON – A USEFULL TOOL

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INTRODUCTION

Thermoluminescent (TL) detectors are applied to dose measurements at Laboratory of Individual and Environmental Dosimetry. Obtained results show that more than 90% of all individual doses measured in terms of $H_p(10)$ and more than 70% of all individual doses measured in terms of $H_p(0.07)$ in Poland are at the level of natural radiation background. However, some doses which exceeded annual dose limit were also registered.

In those cases it is necessary to reassess dose and check the measurement correctness which is especially required in personal dosimetry to ensure reliable and accurate results. By using the phototransferred thermoluminescence (PTTL) method it is possible to reassess doses starting from 5 mSv.

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MATERIALS AND METHOD

In routine control for individual dose measurements whole body and ring dosemeters are used. Four standard sintered MTS-N (LiF: Mg, Ti) detectors are used in whole body dosemeter. One standard sintered detector is placed in the bar coded holder under the 0.4 mm thick plastic cover in ring dosemeter. The TL detectors from whole body dosemeters and ring dosemeters were read in automatic readers (TLD Reader RE-2000). After normal readout detectors were subjected to UV radiation (254 nm length) and read once again.

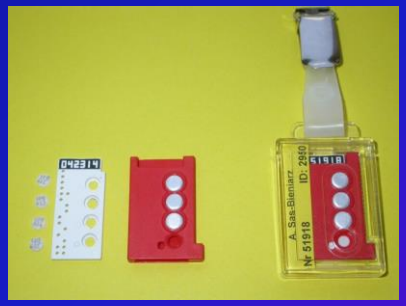

Fig. 1. Whole body dosemeter: 4xMTS-N detectors

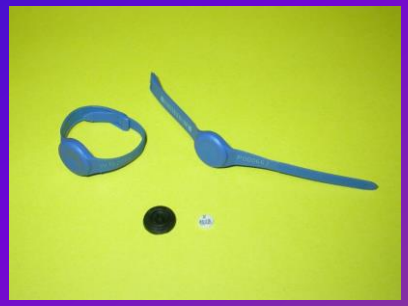

Fig. 2. Ring dosemeter: 1xMTS-N detector

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MATERIALS AND METHOD

PTTL METHOD

THE 1st READOUT

UV IRRADIATION

Fig. 3. UV irradiations were performed by using UV lamp.

Fig. 4. Automatic TLD Readers RE-2000.

THE 2nd READOUT

ANALYSIS

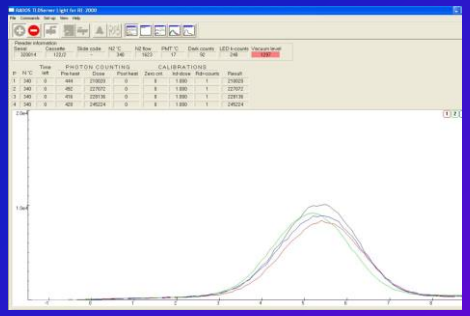

Fig. 5. The glow curves received in the 1st readout.

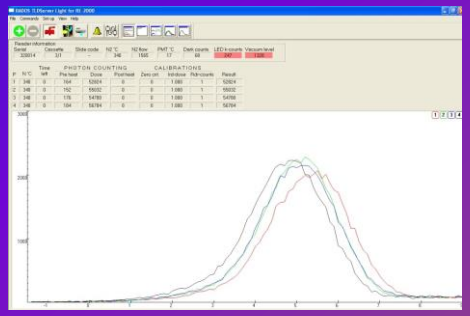

Fig. 6. The glow curves received in the 2nd readout after UV exposure.

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RESULTS

The dose reassessment method for TL measurements, based on PTTL phenomenon has been elaborated at IFJ PAN. The possibility of implementation of this method to dose reassessment for individual dosimetry has been checked. It has been demonstrated that it is possible to implement the PTTL method in the range of $H_p(10)$ starting from 5 mSv to 50 mSv and $H_p(0.07)$ starting from 5 mSv to 1 Sv based on MTS-N detectors. The contribution of the residual dose in evaluating its re-assessed value, and the batch-dependent value of the linear calibration factor require that the “dose history” of TL dosemeters and the batch number of the detectors should be known.

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RESULTS cont.

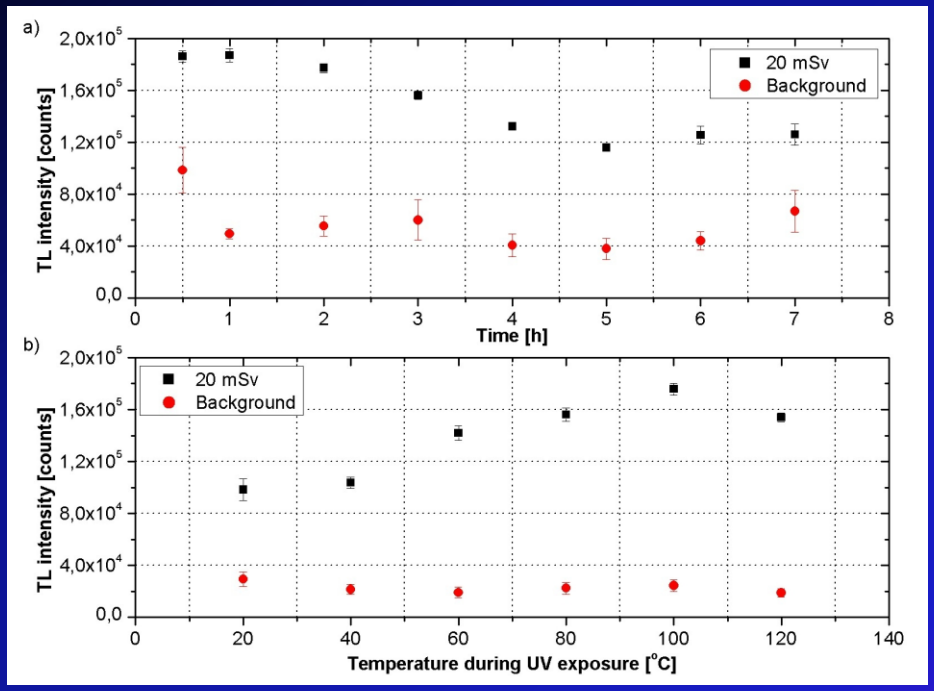

Fig. 7. UV irradiation conditions.

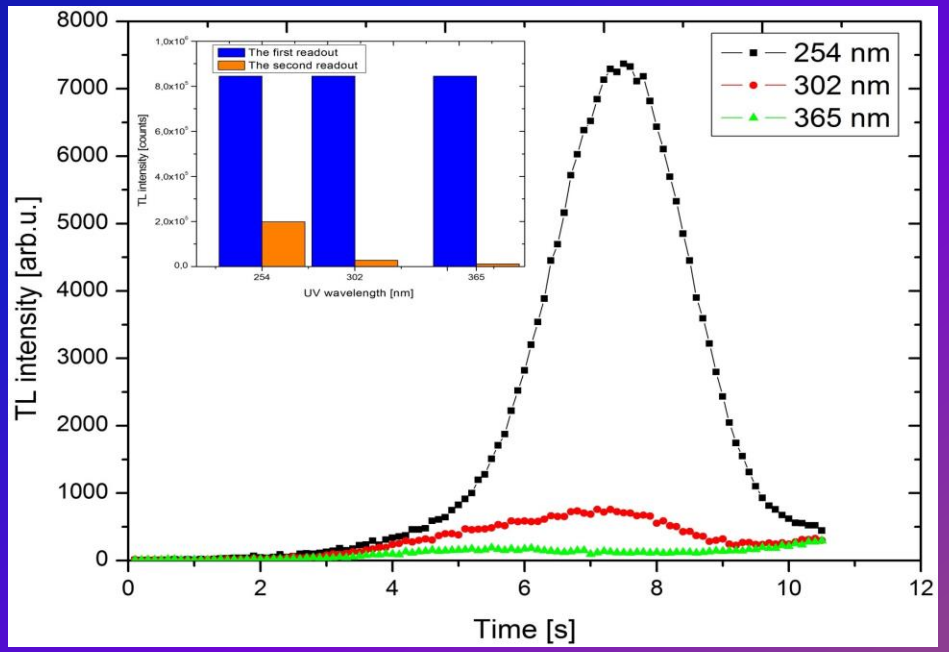

Fig. 8. PTTL response after different UV wavelengths irradiations.

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RESULTS cont.

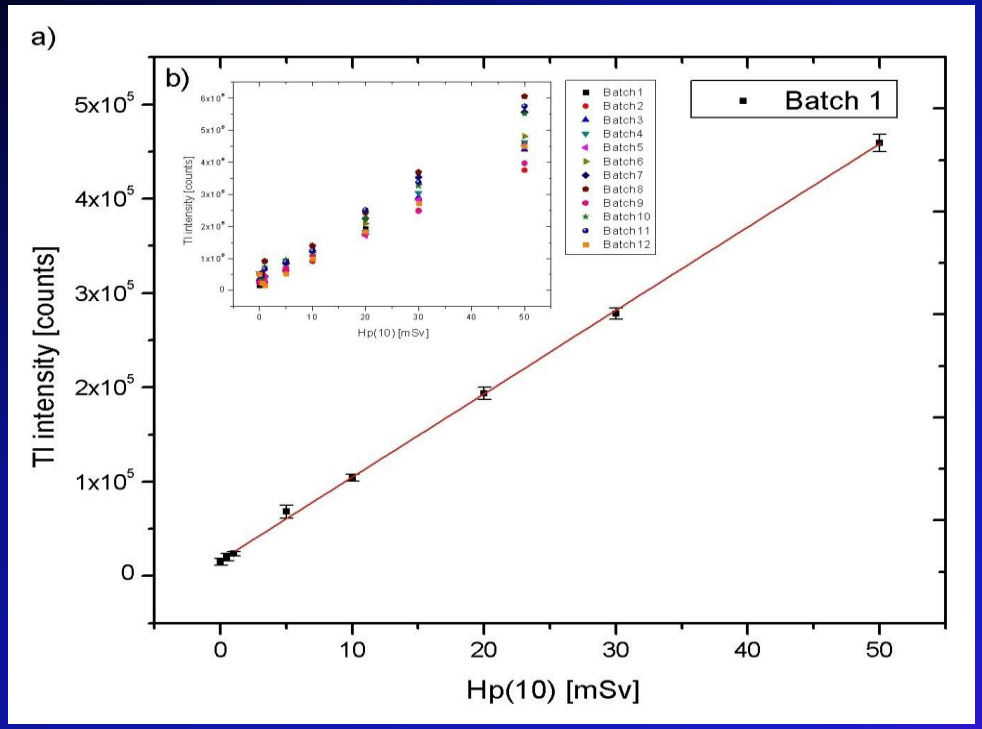

Fig. 9. Dose response of the second PTTL-stimulated readout for:
a) one batch of twelve different batches of MTS-N detectors exposed within the routine dose service;
b) all twelve batches.

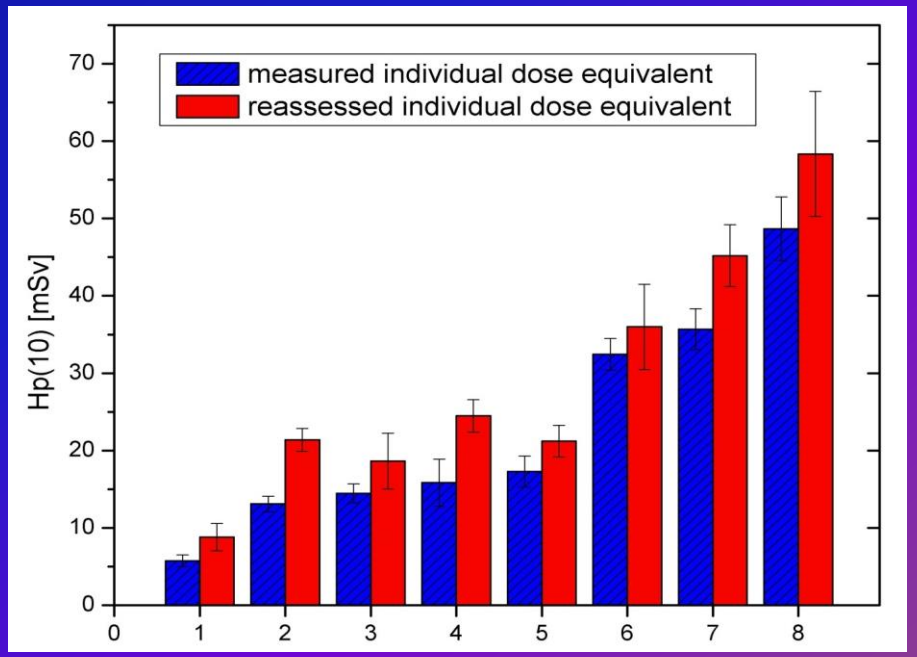

Fig. 10. Comparison between values of individual dose equivalent $H_p(10)$ assessed from the first readout and reassessed from the second PTTL-stimulated readout.

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RESULTS cont.

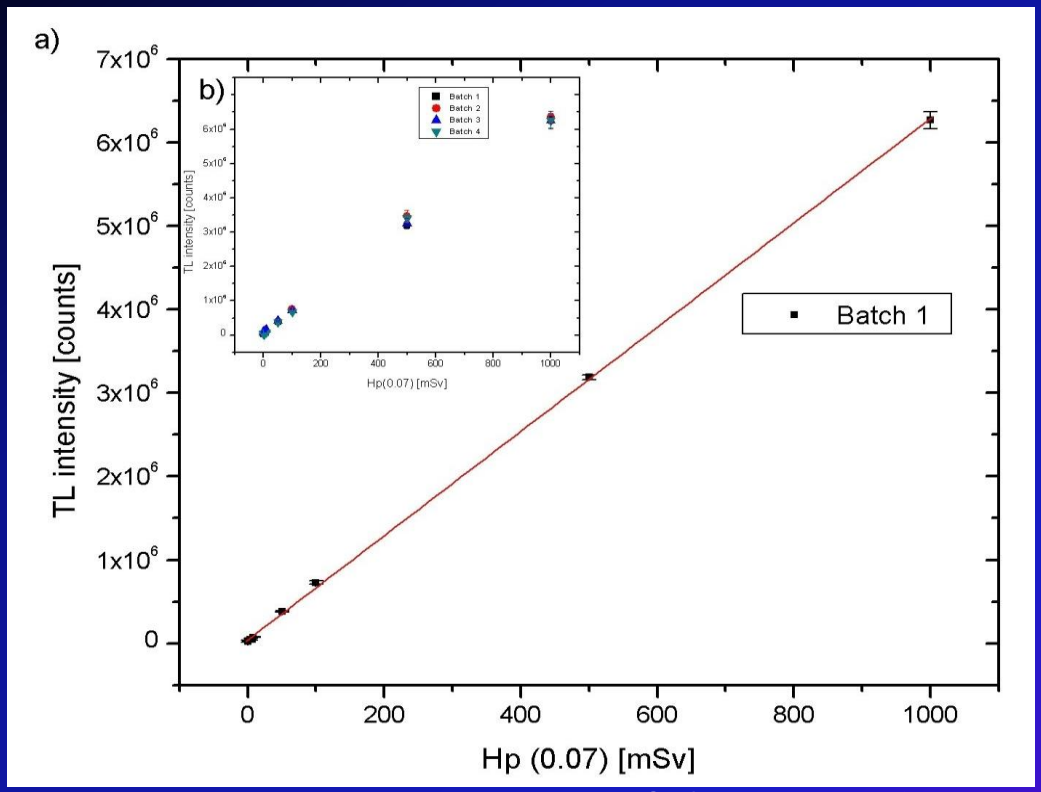

Fig. 11. Dose response of the second PTTL-stimulated readout for:
a) one batch of four different batches of MTS-N detectors exposed within the routine dose service;
b) all four batches.

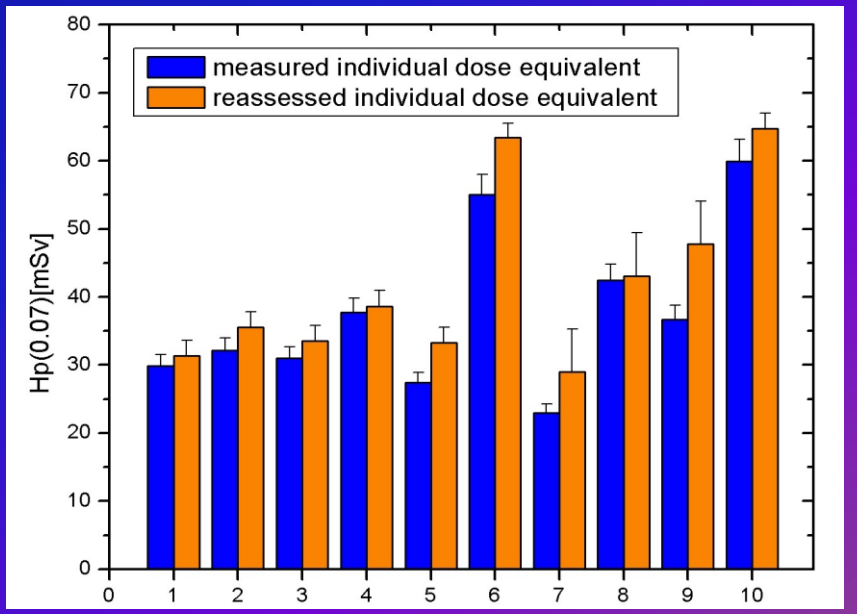

Fig. 12. Comparison between values of individual dose equivalent $H_p(0.07)$ assessed from the first readout and reassessed from the second PTTL-stimulated readout.

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SUMMARY & CONCLUSIONS

Analysis of the results shows:

- It is possible to reassess relatively high doses in individual dosimetry by using the PTTL phenomenon;
- High background after UV irradiation is noticeable;
- Knowing the dosemeter's "dose history" and batch-dependent value of the linear calibration factor it is possible to reassess doses starting from 5 mSv.

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