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Medical Physics Laboratory I

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1 | Objective

- To study the characteristics of Optically stimulated luminescence material ($Al_2O_3:C$ -Alumina)
- To calibrate the OSL research Reader in terms of absorbed dose and find out the unknown dose.

2 | Apparatus

- Alumina discs
- OSL Reader
- Radiation generating equipment (LINAC)
- Blue light Bleaching machine

3 | Theory

3.1 | Types of OSLD

Material	Commercial Name	ρ	Z_{eff}	Glow Peak ($^{\circ}\text{C}$)	Emission (nm)	TL Sens.	Fading
$Al_2O_3:C$	nanoDot	3.95	11.28	~ 200	~ 410	N/A	4% in 3 months
BeO	Thermolox 995	2.85	7.21	$\sim 210, 330$	$\sim 335, 390$	N/A	5–10% in 3 months

4 | Observation

Dose	A	B	Net Intensity
Bg	444	444	0
0.5	15282472	13975510	14628547
1	24422620	23555965	23988848.5
1.5	29594792	29917852	29755878
2	34702132	35937210	35319227
3	45098778	41206552	43152221
UA	32726517	34434890	33580259.5
UB	42256628	39502916	40879328

Table 4.1: Dose-dependent measurements of OSL.

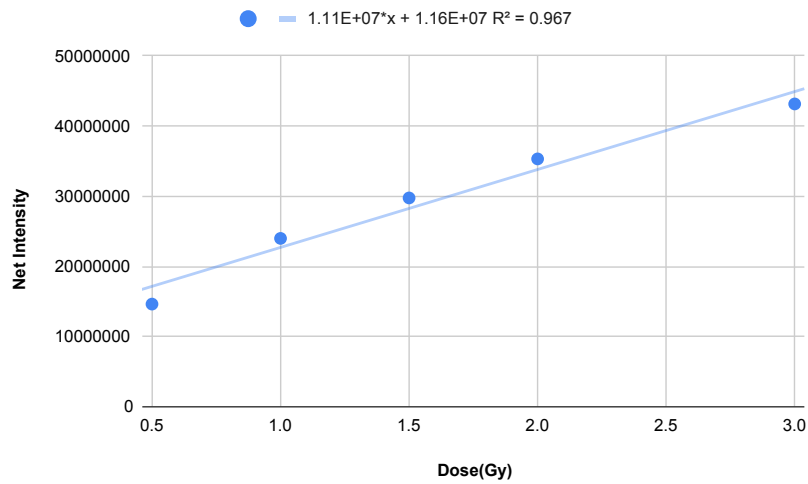


Figure 4.1: Dose vs Average Intensity graph for OSLD.

From the graph, we can see that the relationship between dose and intensity is linear. Using the linear fit equation, we can calculate the unknown doses. Using the linear fit equation:

$$\text{Dose} = \frac{I - 1.16 \times 10^7}{1.11 \times 10^7}$$

Where I = Intensity.

So for unknown A: the intensity is 33580259.5

$$\text{Dose} = \frac{33580259.5 - 1.16 \times 10^7}{1.11 \times 10^7} = \boxed{1.98} \text{ Gy}$$

Similarly, for unknown B: the intensity is 40879328

$$\text{Dose} = \frac{40879328 - 1.16 \times 10^7}{1.11 \times 10^7} = \boxed{2.64} \text{ Gy}$$

Error calculation:

Unknown	Calculated Dose (Gy)	Actual Dose (Gy)	Relative Error (%)
A	1.98	1.78	11.24
B	2.64	2.54	3.93

5 | Conclusion

6 | References