AIM: (a) to understand the physical meaning of thermal quenching effect and to study it in two materials which yield it, namely aluminum oxide (yielding strong thermal quenching) and BeO (yielding moderate thermal quenching).

Materials: Al_2O_3:C, BeO

PROTOCOL:

Step 1. Irradiation (0.5 Gy for synthetic materials, 15 Gy for natural materials)

Step 2. TL measurement (350 °C for synthetic materials, 500 °C for natural materials, HR=1°C/s)

Step 3. TL measurement (350 °C for synthetic materials, 500 °C for natural materials, HR=1°C/s) without any irradiation for background

Step 4. Repeat steps 1-3 for increasing heating rates, namely 2, 4, 5, 8, 10, 15 °C/s

Analysis:

1. Plot Tm, Im, FWHM and Integrated TL peak signal versus HR
2. Plot Integrated TL peak signal versus Tm for all HR
3. Use the following equation to calculate via fitting analysis the thermal quenching parameters W, C.
4. Check whether the two peaks of BeO yield similar thermal quenching results.
5. Verify that Al_2O_3:C yields strong thermal quenching.

$$\eta(T) = \frac{1}{1 + C\exp(-\frac{W}{kT})}$$

NOTE. Analysis will take place for (a) the main dosimetric peak of Al_2O_3:C and (b) the two main dosimetric peaks of BeO individually.

Reference: Engin Aşlar, Niyazi Meriç, Eren Şahiner, George Kitis, George S. Polymeris. “Calculation of thermal quenching parameters in BeO dosimeter using solely TL measurements.” Radiation Measurements 103, 13-25, 2017.

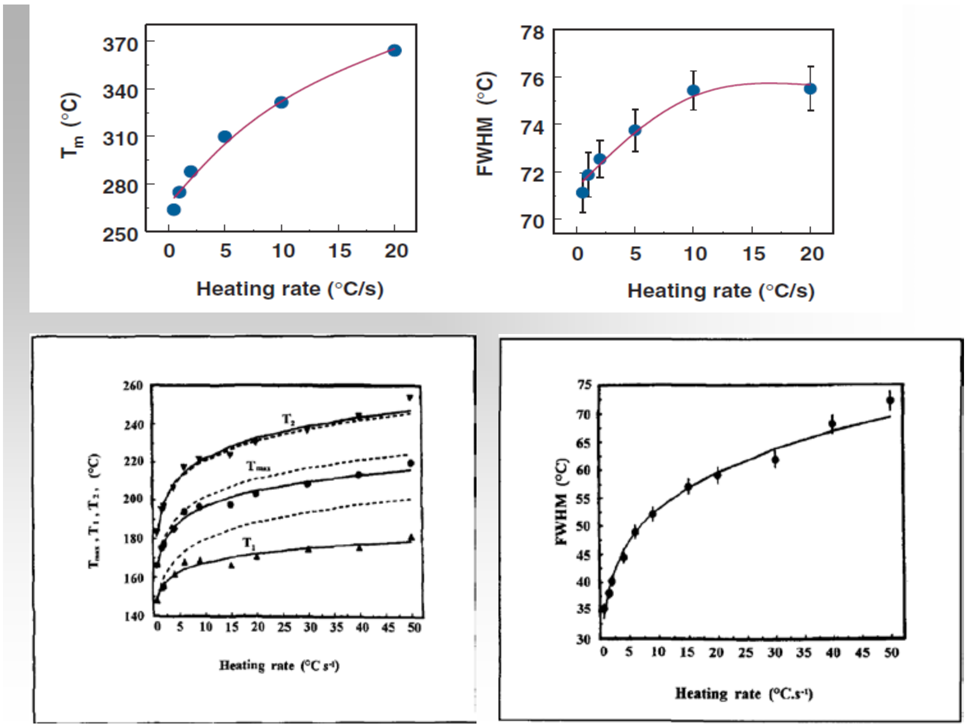

Fig. 1. Various parameters vs HR for BeO.

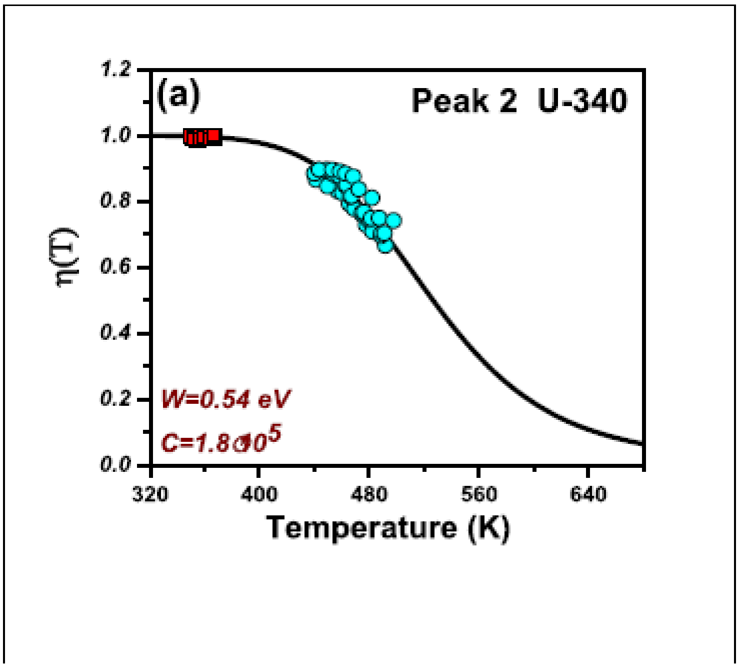

Fig. 2. Calculation of the W,C parameters for the main dosimetric TL peak of BeO.