Light-curing activities of dental resin monomers

C. Schiessl*, M. Rosentritt, R. Cozan, G. Handel
(University Medical Center Regensburg , Department of Prosthetic Dentistry, Germany)

Universitätsklinikum Regensburg

4038

Objectives:

This study aimed to characterize and to compare physical-chemical properties of dental resin monomers during light-polymerization in photo-dynamic scanning calorimetry (DSC).

Methods:

Eleven resin base monomers (Tab.1, Fig.3, 4) were prepared with camphorquinone and ethyl-4-dimethylaminebenziate for light activation. Each specimen (n=3) was photo-polymerized five-times (800 mW/cm^2 40s, standard) with the Elipar Trilight polymerization device (3M ESPE, Seefeld, G) during photo-DSC-measurement (DSC Plus, Rheometric Scientific, GB). The reference cup was empty. The released energy (heat) during the light-polymerization as well as time, temperature and heatflow at peak maximum were analyzed with the Software Plus V5.44 (Rheometric Scientific, GB) (Fig.1, 2, 5). Statistics: mean, standard deviation, t-test ($\alpha = 0.05$).

Results:

monomer	heat [J/g]	point of maximum [s]	temperature at maximum [°C]	heatflow [mcal/s]
D3MA	148.4	38.0	44.6	42.9
DITMPTA	927.6	9.7	54.2	71.1
EBPADMA	389.4	13.7	46.1	47.9
HDDMA	155.6	38.0	42.8	43.5
HEMA	37.1	40.7	45.9	41.2
HPMA	110.8	40.7	46.0	43.7
PEG 400	562.3	35.7	48.0	48.2
PEG 600	161.5	40.0	46.6	43.1
TEGDMA	257.6	40.3	46.3	42.9
TMPTMA	379.3	19.4	45.4	46.3
UDMA	330.3	13.3	46.7	43.2

Table 1: Results

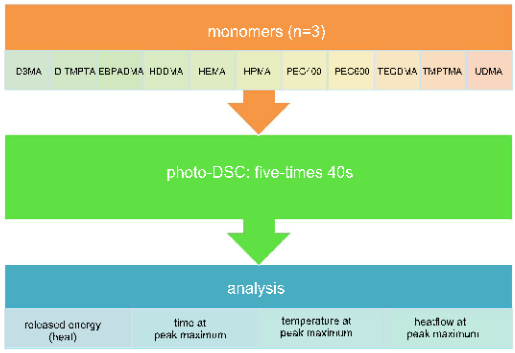

Figure 1: Description of the study

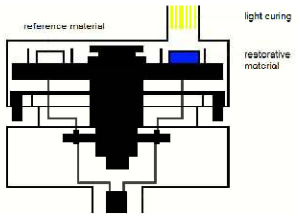

Figure 2: Photo-DSC set-up

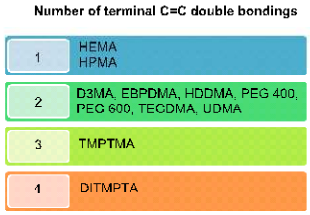

Figure 3: Number of terminal C=C double bondings

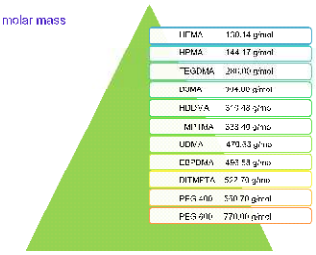

Figure 4: Molar mass of the monomers

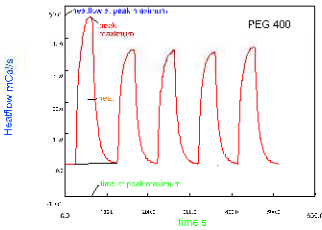

Figure 5: Analyzed subtraction curve without temperature as example

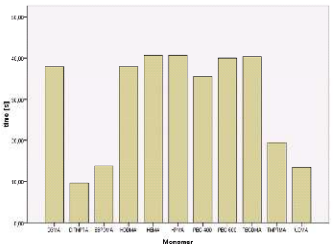

Figure 6: Time at peak maximum

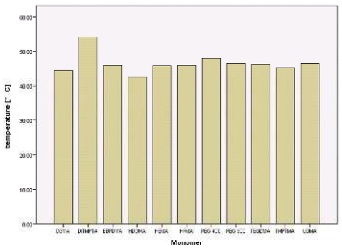

Figure 7: Temperature at peak maximum

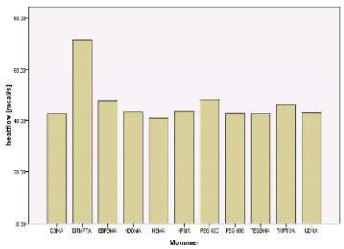

Figure 8: Heatflow at peak maximum

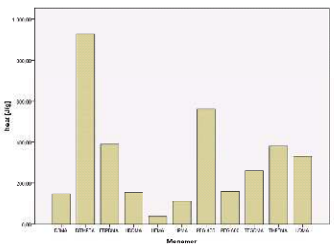

Figure 9: Released energy (heat) at peak maximum

Statistically significant differences ($p<0.05$) were observed in heat, point of peak maximum, temperature at maximum and heatflow.

Conclusion:

During polymerization reaction of the materials changes in energy indicate differences between the tested materials. Photo-DSC allows differentiating between monomers and provides information about the intensity (heat) and the speed (time until peak maximum) of reaction of the monomers (Fig. 6, 7, 8, 9). DITMPTA reacted significantly faster than the other monomers. Neither the molar mass nor the number of terminal C=C double bondings had a significant influence on the results (Fig. 3, 4).