

# PRE-HEATED COMPOSITE: TEMPERATURE EFFECT ON MONOMER CONVERSION AND CONTRACTION STRESS

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## INTRODUCTION

Recently, it was demonstrated that pre-heating a commercial composite prior to photo-activation significantly increases monomer conversion, possibly reducing the light exposure duration (Daronch *et al.*, 2005). However, temperature increase is associated with higher rates of conversion, which could result in elevated values of contraction stress.

This study investigated the influence of composite curing temperature and light-exposure duration on monomer conversion and contraction stress of a commercial micro-hybrid resin composite.

### HYPOTHESES:

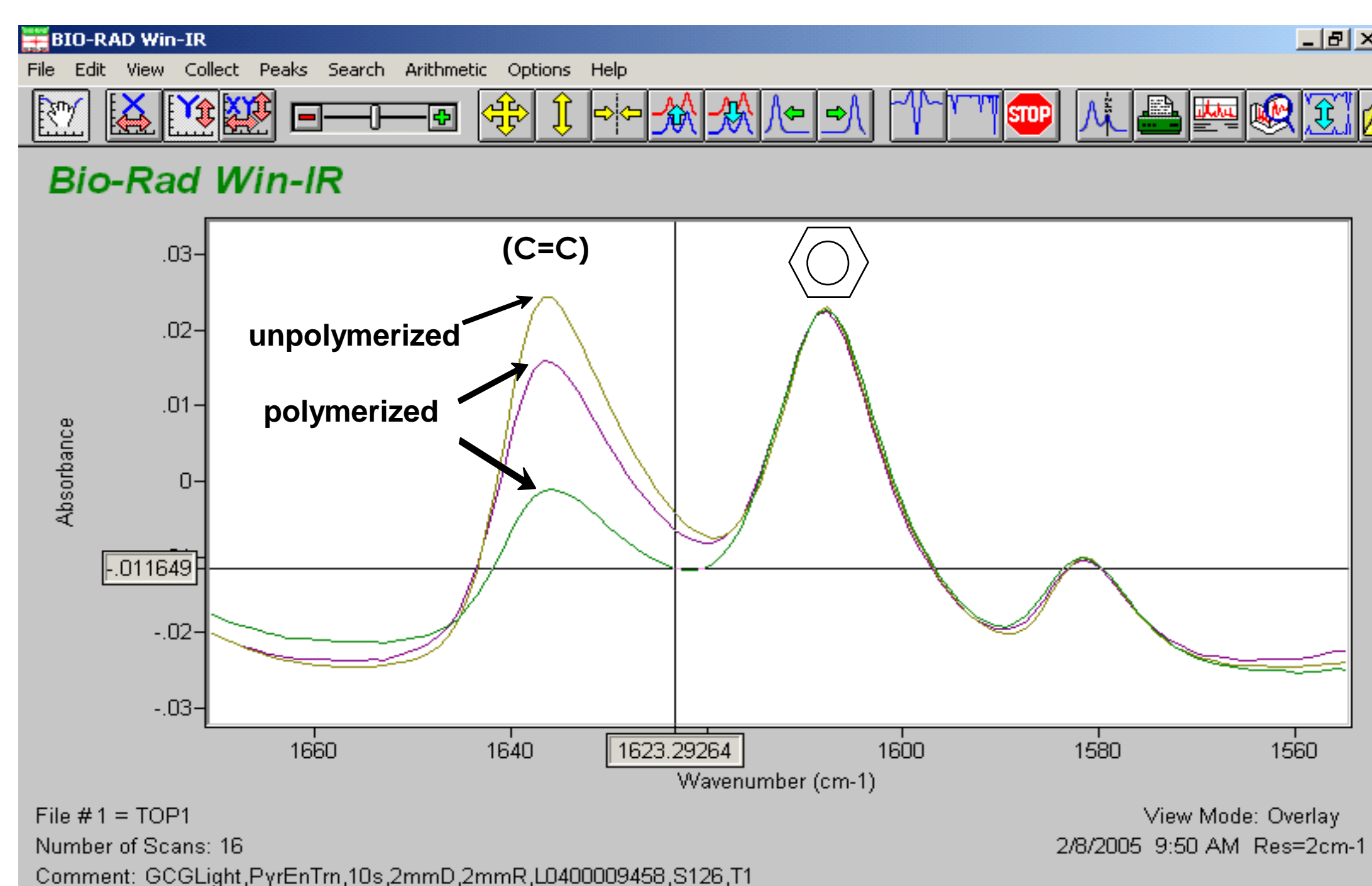
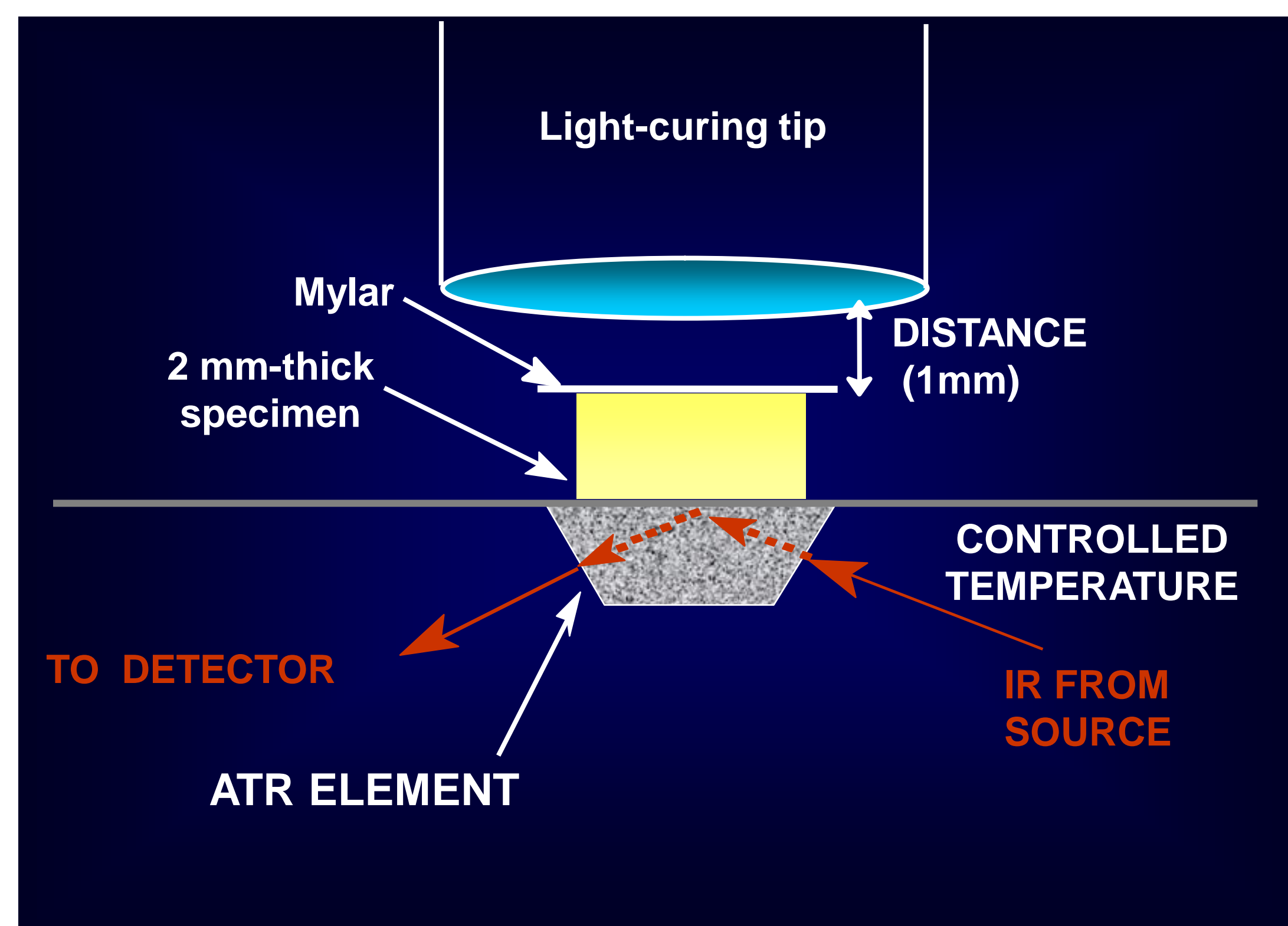
1. An elevation in composite temperature prior to curing increases monomer conversion and contraction stress values;
2. Pre-heated composite requires shorter exposure duration to achieve similar conversion values as those seen when using conventional exposures at room temperature, and, therefore, the contraction stress may be reduced.

## MATERIALS AND METHODS

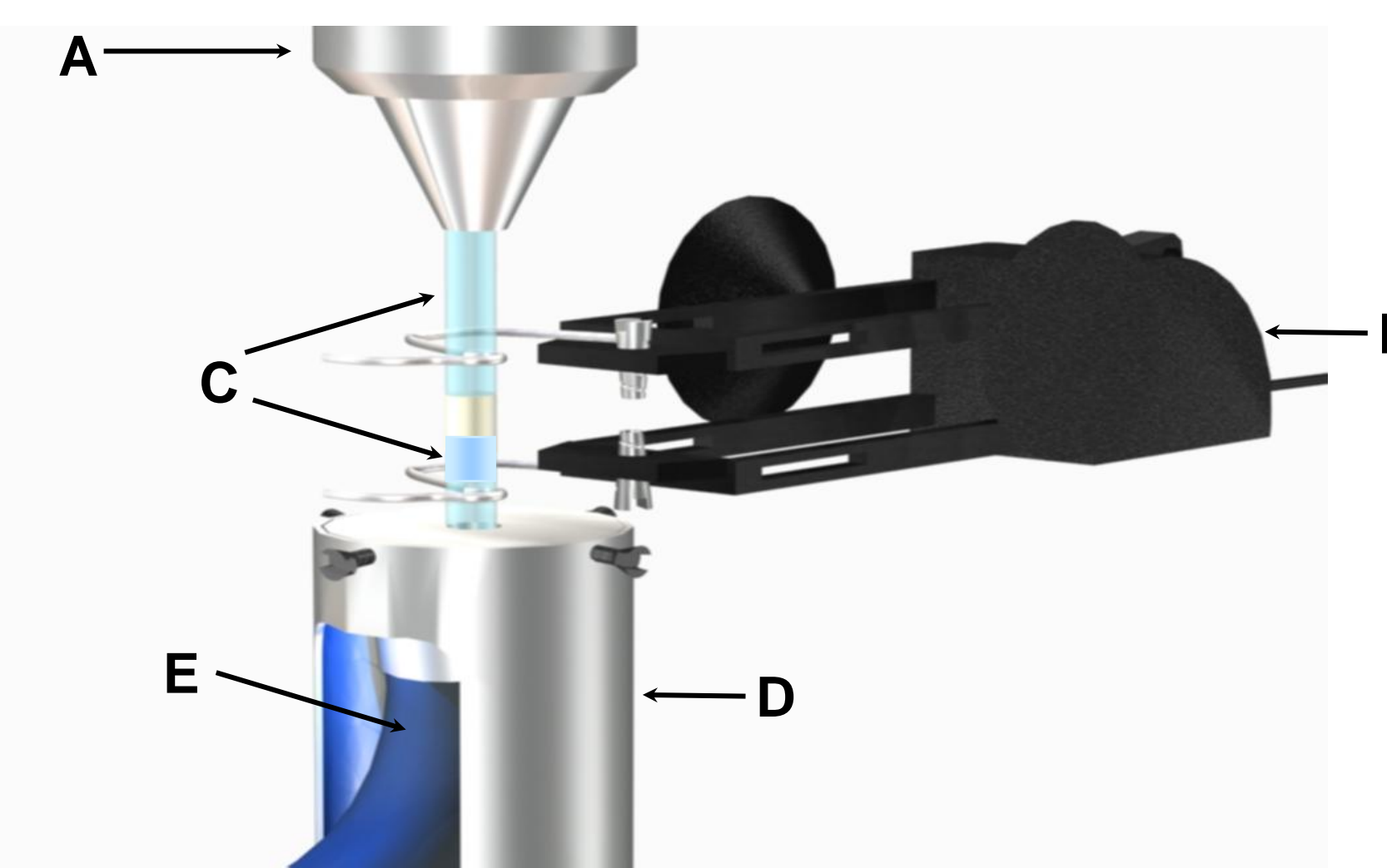
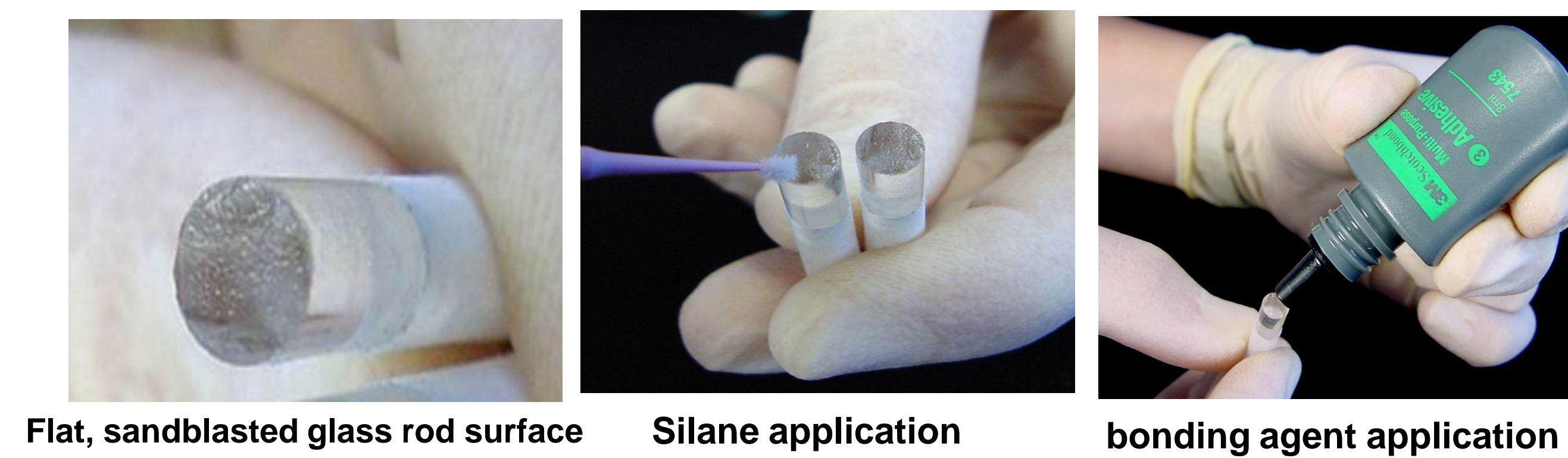
- ✓ Composite: Esthet•X (Caulk-Dentsply), shade A2
- ✓ Light-exposure durations: 5s or 20s (control)
- ✓ QTH conventional light-curing unit: Optilux 501(Kerr), 630 mW/cm<sup>2</sup>
- ✓ Composite pre-cure temperatures: 22° C (control) / 60° C

### MONOMER CONVERSION ANALYSES

FTIR – ATR SPECTROSCOPY- FTS-40 (Digilab/Bio-Rad)



### CONTRACTION STRESS TEST



Contraction stress test set-up

- A: chuck connected to the load cell
- B: Extensometer
- C: Glass rods
- D: Metallic fixture for light-curing tip (E)

Data were analyzed with t-test, 2-way ANOVA and Tukey test ( $\alpha=5\%$ )



## RESULTS

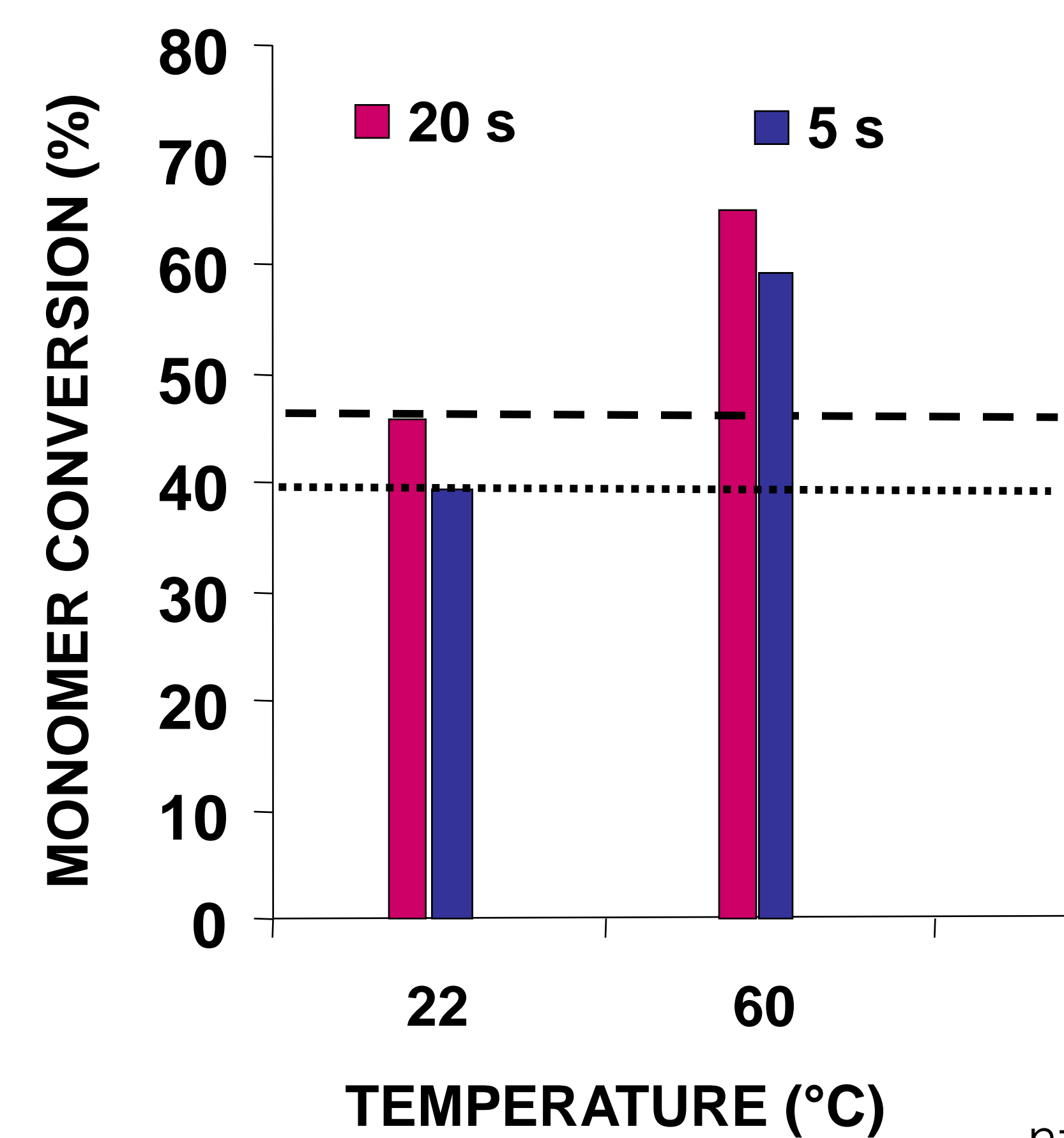
Temperature (°C) / exposure duration (s)	Monomer conversion (%)	Max. Contraction stress (MPa)	Final Contraction stress (MPa)	Relaxation (%)
22 / 5	39.1 (7.1)c	1.6 (0.2) D	1.6 (0.3) b	0.5
22 / 20 (control)	47.2 (1.9)b	5.2 (1.1) B	5.1 (1.1) a	0.0
60 / 5	59.4 (5.4)a	3.2 (0.7) C	2.7 (0.8) b*	15.5
60 / 20	64.7 (2.0)a	6.9 (0.6) A	5.2 (1.0) a**	25.4

Within a column, groups identified with similar letters are not statistically different,  $p > 0.05$

\* t-test between Max and Final stress:  $p = 0.055$

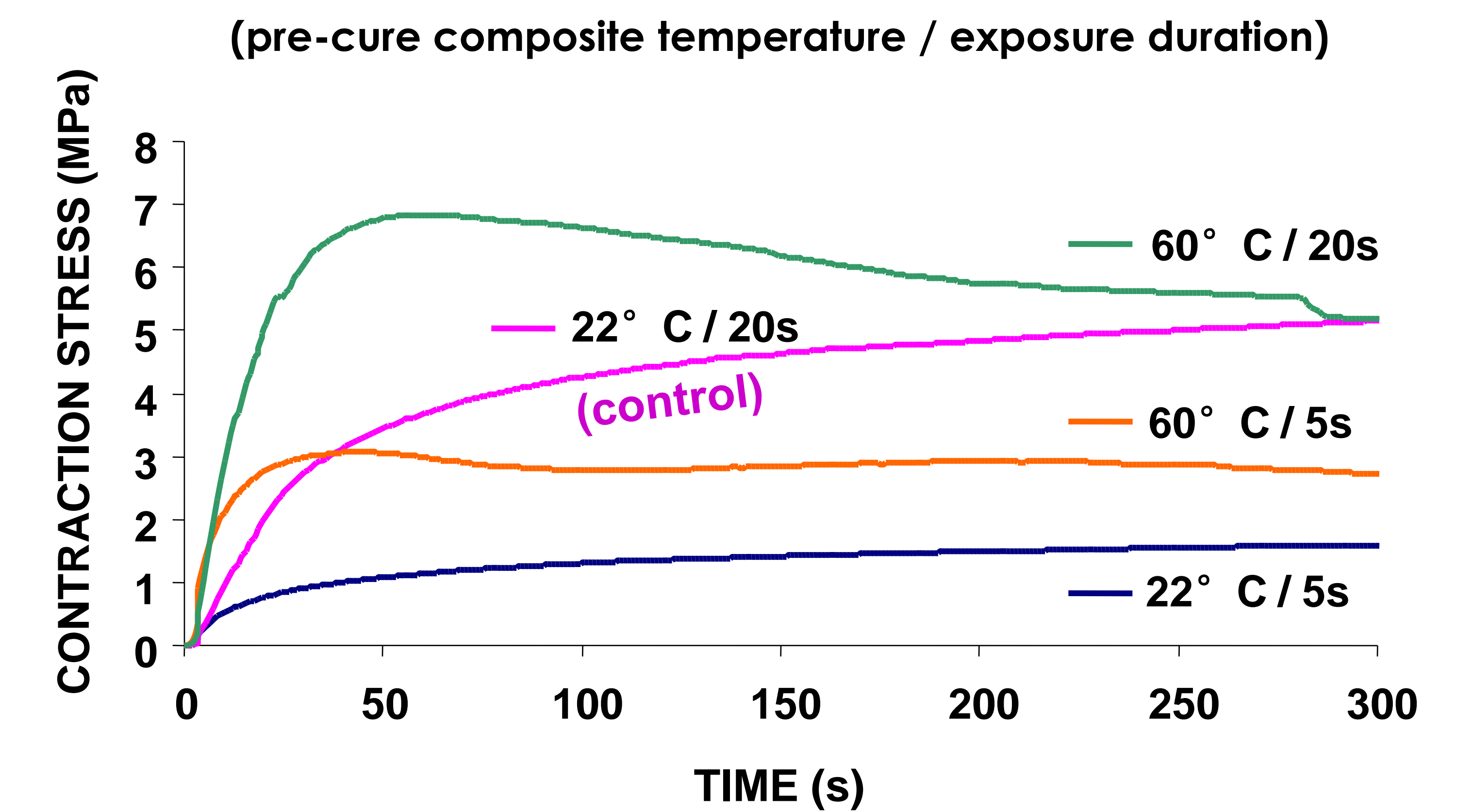
\*\* t-test between Max and Final stress:  $p < 0.01$

### EFFECT OF TEMPERATURE AND EXPOSURE DURATION ON MONOMER CONVERSION



n=10 specimens per experimental group

### EFFECT OF TEMPERATURE AND EXPOSURE DURATION ON CONTRACTION STRESS



## CONCLUSIONS

Both hypotheses were accepted. Based on limitations imposed, the following conclusions may be drawn:

- ✓ For equivalent exposure durations, temperature increase produced higher monomer conversion and contraction stress values.
- ✓ Pre-heated composite allowed use of shorter exposure duration of 75%, producing higher conversion and lower contraction stress than control.