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PDMS Shrinkage

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PDMS Shrinkage

Abstract

Determine the degree of Polydimethylsiloxane (PDMS) based mold shrinkage at low and elevated curing temperatures and different thicknesses.

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Critical Factors

- PDMS post-cure shrinkage reduces with reduced bake temperature.
- PDMS post-cure shrinkage reduces with reduced thickness of the PDMS.
- Curing at room temperature: ~0.3% shrinkage.
- Curing at 60C: ~1.4% shrinkage.
- Curing at 80C: ~1.6% shrinkage.

Goal:

- To determine the degree of Polydimethylsiloxane (PDMS) based mold shrinkage at low and elevated curing temperatures and different thicknesses.

Materials:

- PDMS base
- PDMS curing agent
- 3 inch Silicon Wafers (2) with 10um high features
- 6 Aluminum dishes

Equipment:

- Zeiss SmartZoom5 2D/3D Optical Microscope
- Degassing chamber

Protocol:

Wafer preparation:

- 1 Cleave each wafer into 3 pieces orthogonal to the major flat.
- 2 Place each piece in an aluminum dish.

PDMS preparation:

- 1 Prepare 10:1 ratio mixture of PDMS base and curing agent by weight.
- 2 Ensure PDMS base-curing agent mixture is adequately mixed, approximately 5 minutes of continuous mixing.
- 3 Pour either 30g or 50g of PDMS mixture over each wafer piece in the aluminum dish and ensure that the dish is level.
- 4 Place the aluminum dishes in the desiccator and evacuate the desiccation chamber to degas the PDMS for 20 minutes.

PDMS curing at different temperatures:

1. Separate aluminum dishes into 3 pairs, containing 30 and 50 grams of PDMS each.
2. Place one pair to be cured at room temperature for 48 hours.
3. Place second pair in oven at 60C and proceed to cure for 20 minutes before retrieval.
4. Place third pair in oven at 80C and proceed to cure for 20 minutes before retrieval.

PDMS shrinkage characterization:

1. Use the Zeiss SmartZoom5 Optical Microscope image stitching feature to create a stitched image.
2. Measure length across 10mm features.

Results:

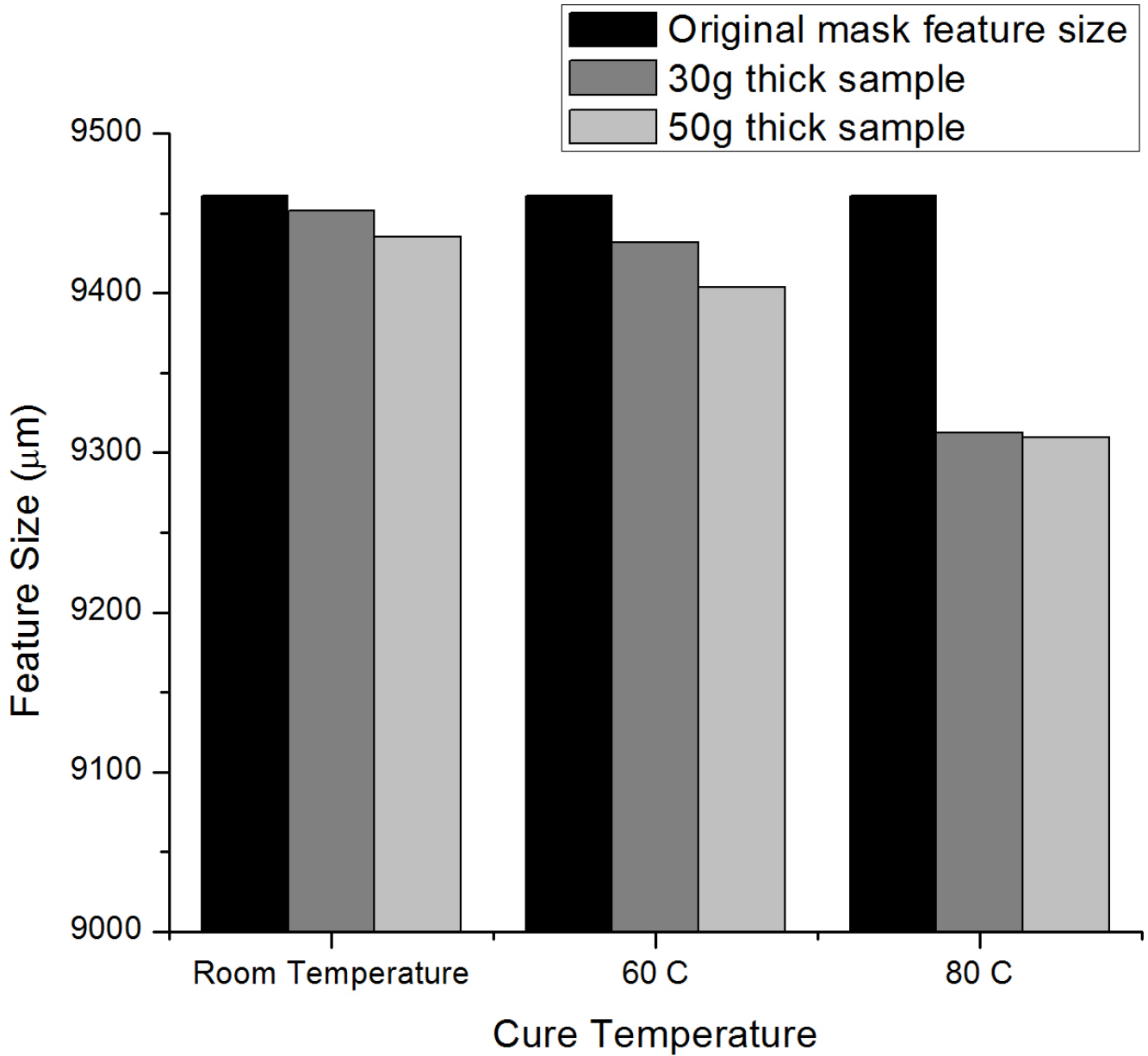


Fig.1: Feature length measurements across 10mm features for mask and PDMS mold samples cured at different temperatures

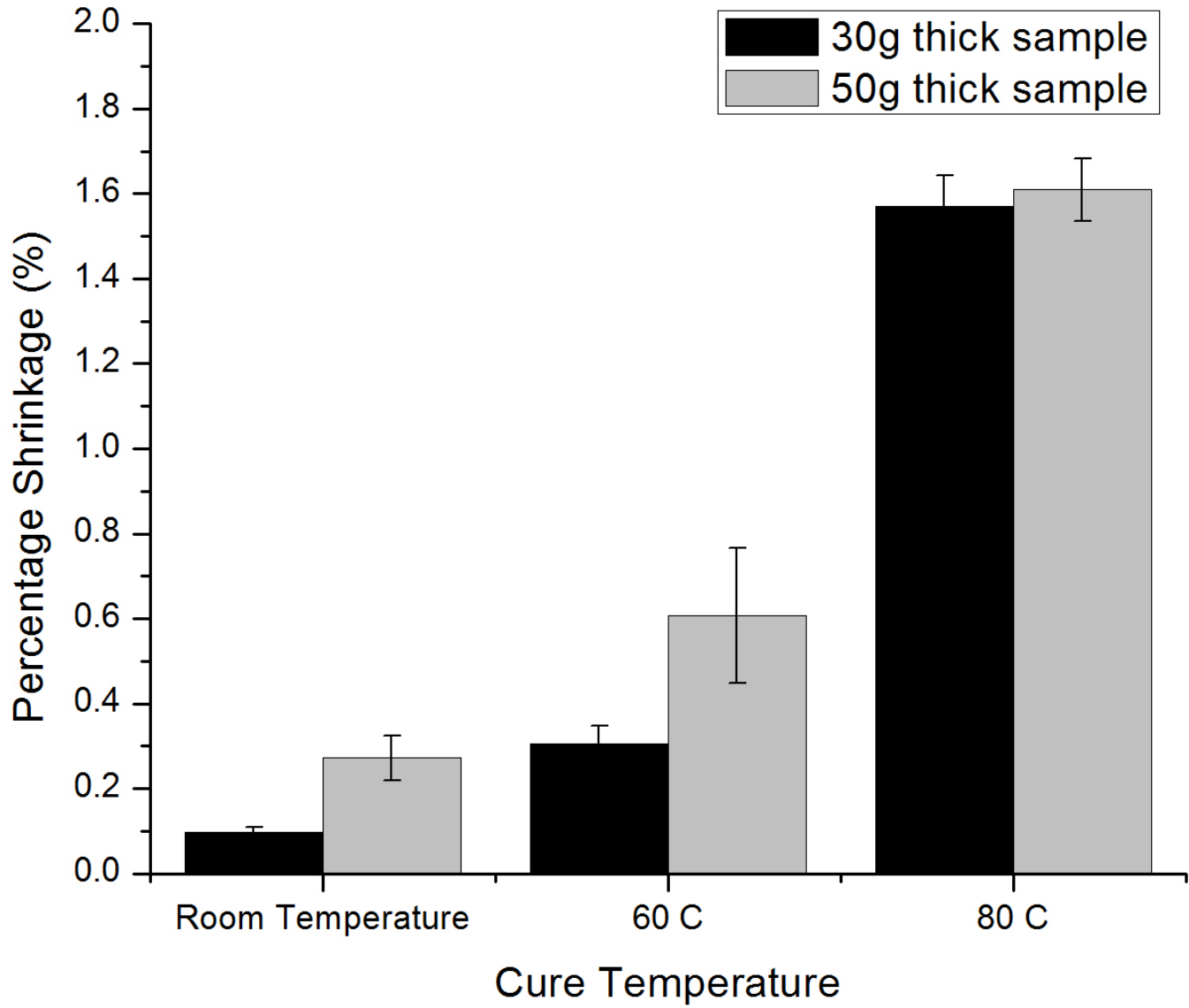


Fig.2: Percentage mold shrinkage across 4 linewidth features for 3 mold samples cured at different temperatures