

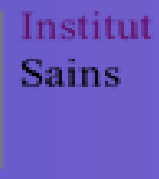
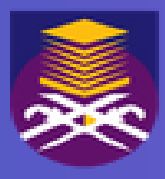
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Tensile and Elastic Behavior of Sylgard 184 Polydimethylsiloxane under Varying Curing Agent Ratios

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Abstract

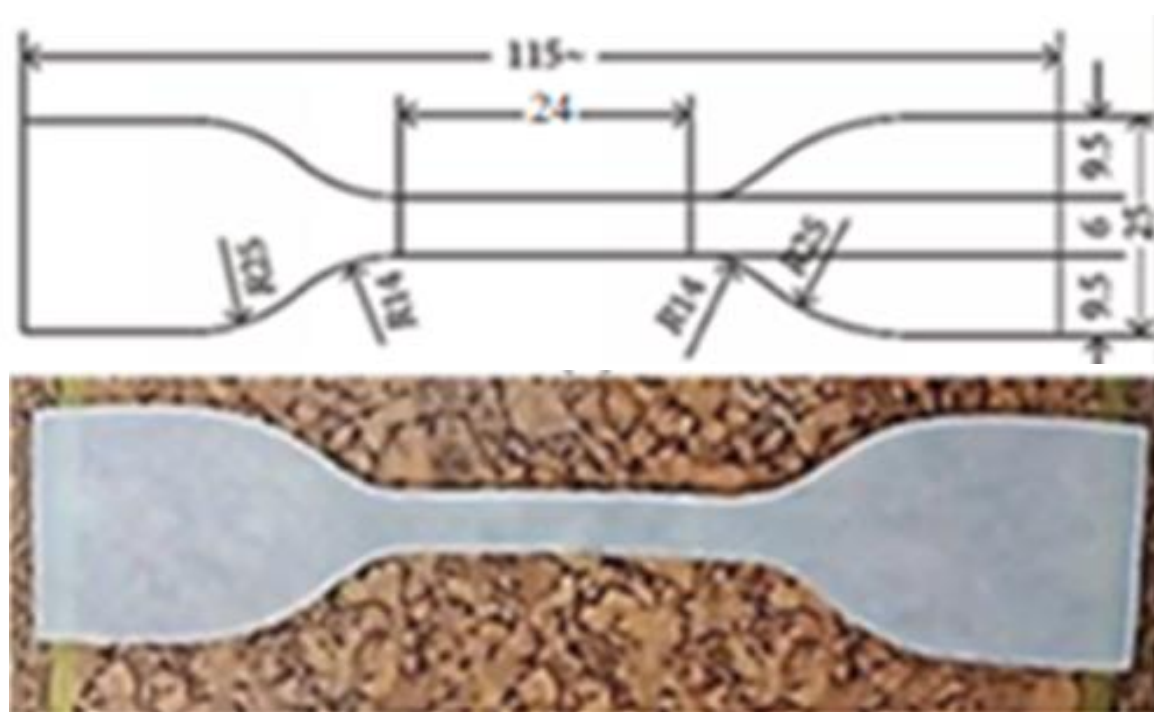
Polydimethylsiloxane (PDMS) is a silicone-based elastomer widely used in biomedical engineering, microfluidics, and flexible electronics due to its thermal stability, flexibility, and biocompatibility. The mechanical properties of PDMS are significantly influenced by its curing process, particularly the ratio of base polymer to curing agent and the curing temperature. While the standard 10:1 ratio is commonly used, few studies have investigated the mechanical implications of alternative curing agent ratios and temperature combinations. This study explores the effect of different curing agent ratios (10:0.75, 10:1, and 10:1.25) and two curing temperatures (ambient temperature and 100 °C) on the tensile strength and modulus of elasticity of PDMS. The samples were prepared using Sylgard 184 and subjected to ASTM D412 standardized tensile testing. The results revealed that the 10:1 ratio cured at ambient temperature provided the highest tensile strength with the value of 2.07 MPa while the 10:1.25 ratio cured also at ambient temperature produced the highest modulus of elasticity with the value of 2.83 MPa. These findings indicate a trade-off between flexibility and stiffness depending on the curing strategy.

Introduction

PDMS is widely used for its thermal stability and biocompatibility in applications such as microfluidics and biomedical devices. Its mechanical performance is influenced by the curing agent ratio and curing temperature. This study aims to evaluate the tensile strength and Young's modulus for 10:0.75, 10:1 and 10:1.25 ratios cured at ambient temperature and 100 °C as these curing parameters remain relatively unexplored.

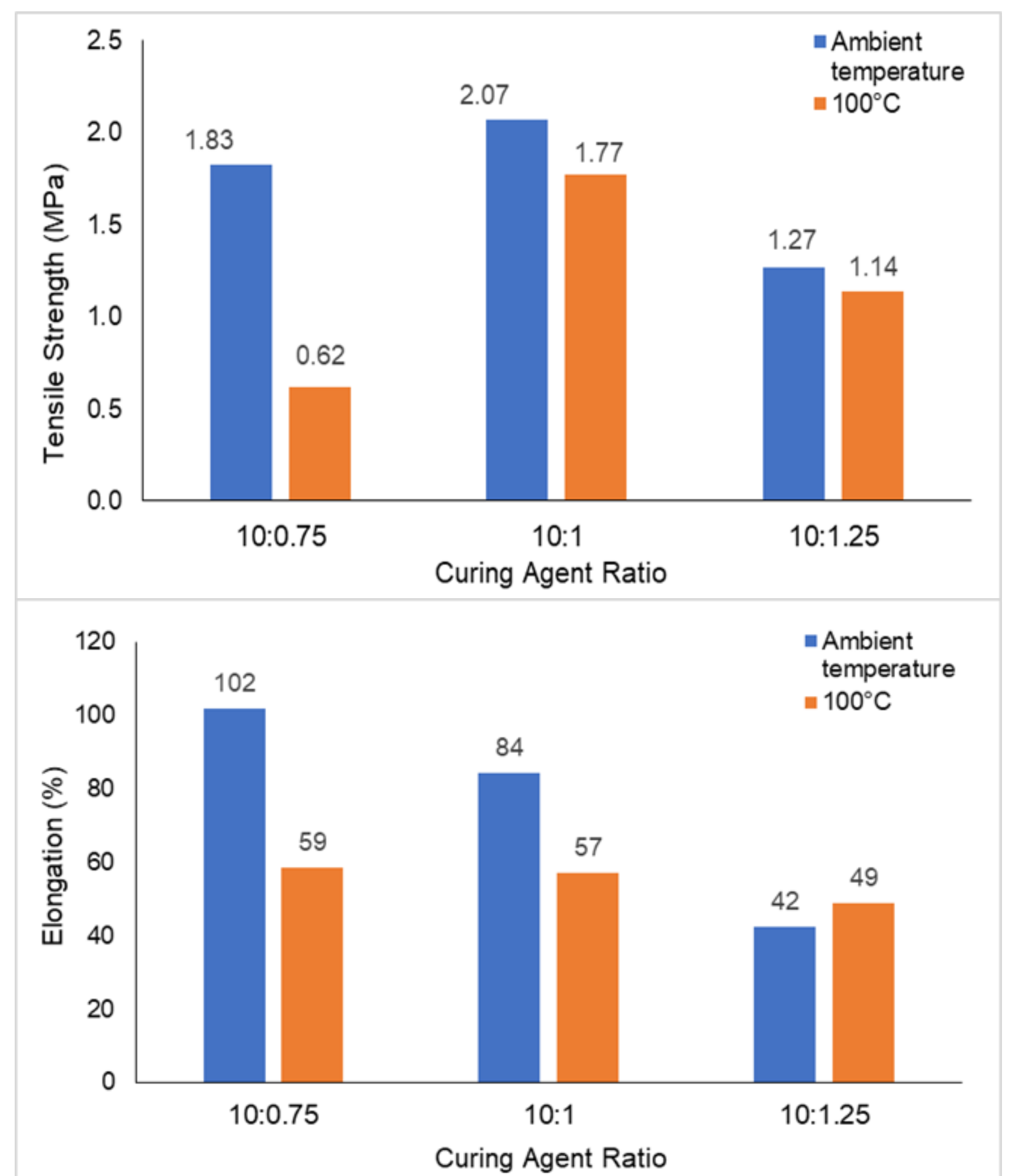
Methodology

- Sample preparation
 - PDMS (Sylgard 184) mixed at 3 base polymer to curing agent ratios: 10:0.75, 10:1, 10:1.25.
 - Mixture stirred at 200 rpm for 2 minutes.
 - Pour into container and cut into ASTM D412 dumbbell/dog bone shaped.
 - Curing temperatures: Ambient temperature for 2 days and 100 °C in the oven for 45 minutes.
- Tensile test
 - Machine: Tinius Olsen H50KT with strain rate of 500 mm/min.



Tensile strength and elongation

- Highest tensile strength is 2.07 MPa by 10:1 sample treated at ambient temperature.
- Highest elongation is 10:0.75 sample cured at ambient temperature with 102%.
- Higher crosslinking density due excessive curing agent enhances stiffness but compromises ductility.



Conclusion

The study demonstrates that the mechanical properties of PDMS can be effectively tailored through systematic control of curing parameters. Such optimization is beneficial for advancing its applications in specialized areas such as soft robotics, wearable sensors, and biomedical devices.

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Young's modulus

- Highest Young's Modulus is 2.83 MPa by 10:1.25 sample treated at ambient temperature.
- Excess curing agent (10:1.25) leads to stiffer material

