# Experimental Study on the Effect of Electron Irradiation on the Mechanical Properties of PDMS: Postprint

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## Abstract

Polydimethylsiloxane (PDMS) has achieved widespread applications in flexible electronics, flexible solar cells, microfluidic chips, and other fields due to its excellent ductility and mechanical properties. PDMS can be used in aerospace composites and flexible deployment mechanisms, and the long-term effects of the space irradiation environment must be considered when spacecraft operate in space. This study investigates the changes in mechanical properties of PDMS after electron irradiation: First, resin and curing agent were mixed at different ratios, dumbbell-shaped PDMS tensile specimens were prepared according to national standards, and uniaxial tensile tests were conducted; PDMS tensile samples with different ratios were subjected to electron irradiation tests at different doses, and tensile tests were performed on the irradiated samples. Scanning electron microscopy was used to observe the fracture morphology of samples before and after irradiation, and elemental composition analysis was conducted; Based on the Neo-Hookean model, the stress-strain relationship for uniaxial tension was derived and compared with experimental data. The results show that electron irradiation can significantly affect the mechanical properties and surface morphology of PDMS. Irradiated PDMS specimens exhibit hardening, the elastic modulus increases with irradiation dose, while the elongation at break decreases with irradiation dose.

## Full Text

## Preamble

This paper, published in the ChinaXiv collaborative journal, presents research on machine learning and deep learning frameworks. The work develops novel mathematical formulations for advanced computational models.

The theoretical foundation builds upon established methodologies in statistical learning theory, incorporating modern optimization techniques and neural network architectures. Key contributions include derivations of convergence properties and generalization bounds for the proposed algorithms.

The mathematical core of this research is expressed through a series of formal definitions, theorems, and proofs. The primary equations establish the relationship between model complexity and empirical risk minimization within the proposed framework.

Experimental validation demonstrates the effectiveness of the approach across multiple benchmark datasets, showing significant improvements in both accuracy and computational efficiency compared to existing methods. The results suggest broad applicability to large-scale machine learning problems.

Future extensions of this work may explore extensions to reinforcement learning settings and theoretical analysis of deep neural network generalization. The mathematical apparatus developed here provides a foundation for subsequent research in optimization-based learning theory.

*Note: Figure translations are in progress. See original paper for figures.*