# Mechanical Properties of GO Based Thin Polymer Films: Experiments and Simulations

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## 1. Introduction

Understanding mechanical properties of thin polymer films is important to identify the durability of them. Thin polymer films are widely studied for various engineering applications due to their excellent material properties. Various methods are used for fabricating thin polymer films: solvent casting, painting, spray processing, printing, spin coating, floating technique, pulsed laser deposition techniques, and layer-by-layer (LbL). Among them, the thin polymer films, which are synthesized by LbL method, are particularly interesting to fabricate multifunctional polymer products.

Previous studies indicated that it is possible to enhance the material properties of LbL-based thin polymer films by introducing nanomaterials as a key component. Specifically, LbL films can be used to provide enhancing mechanical robustness for certain engineering products. GO-based thin polymer films are currently an increasing interest in the LbL study.

Even though many studies are actively pursued for improving the durability of GO-based LbL films, there is a lack of fundamental knowledge about their mechanical properties, such as elastic modulus and hardness. In order to understand the durability of GO-based LbL films, the mechanical properties of GO-based LbL films should be studied.

This present research examines both the hardness and the elastic modulus of graphene GO-based thin polymer films by using nanoindentation experiments. GO-based thin polymer films were fabricated by LbL self-assembly technique. It is found that the mechanical properties of the film structures are mainly affected by interfacial bonding strength. By using reduced GO as a main component, it is possible to improve the hardness and the elastic modulus of the films. Moreover, finite element analysis (FEA) models of GO-based thin polymer films have been established. FEA results indicate that LbL assembly can enhance overall mechanical properties of the GO-based thin polymer films.

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