Graphene-based Opto-responsive Actuators for Microgripper and Microvalve Applications

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Abstract

Recent smart materials can convert various forms of energy into mechanical work, enabling actuation. These actuations typically cause structural deformation in materials when exposed to various stimuli, such as light, electricity, magnetic fields, heat, pH variations, or atmospheric moisture [1][2]. In this study, we have developed an optical actuator using thermally reduced graphene oxide and elastomer-based composites. The optical actuator films were utilized for two distinct applications: soft grippers and microvalves. The prepared optical actuator film demonstrated photomechanical actuation, achieving a deformation angle of 14°-33° within 1 minute. The measured photomechanical force of the actuator film was approximately 3 mN. The developed soft gripper prototype exhibited a gripping capacity of 1.3 g for nearly 11-12 seconds, with a release time of 3.2 seconds for the test specimens. Additionally, the microvalve prototype achieved a flow rate of approximately 30 µL/min.

References

[1] Ying Hu, Zhe Li, Tian Lan, Wei Chen. Advanced Materials, 47 (2016) 10548-10556.
[2] M. N. Muralidharan, Seema Ansari. Advanced Materials Letters, 12 (2013) 927-932.

Figures

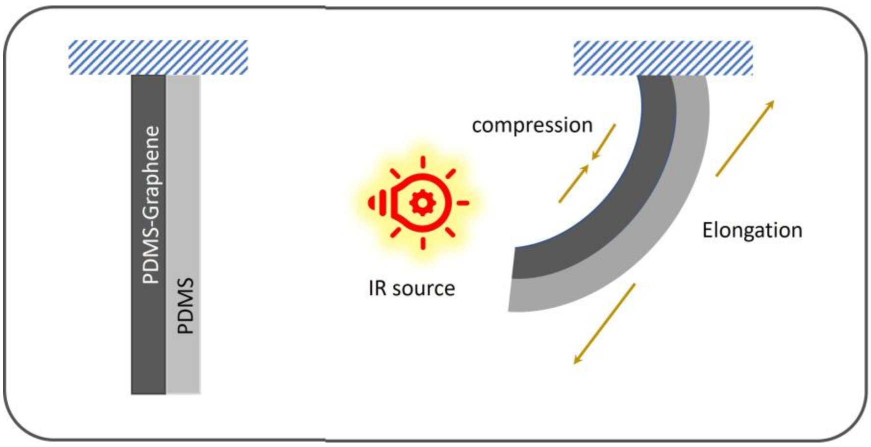

Figure 1: Schematic representation of an optical actuator working