Reduced Graphene Oxide Based Transparent Conducting Electrodes for Acoustic Actuator Application

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Abstract
Transparent thin-film acoustic actuators made from piezoelectric polymers is an emerging area in flexible devices due to its smaller size, low power consumption, and light weight. Transparent acoustic actuators require transparent conducting electrodes (TCEs) to allow electrical signals to be applied without obstructing light transmission, which is crucial for integrating audio functionality into optically transparent platforms such as displays, smart windows, and interactive surfaces [1,2]. Graphene-based materials can be used as high-performance TCEs due to their unique combination of excellent electrical conductivity, high optical transmittance, and mechanical flexibility. The reduced graphene oxide (rGO) can achieve optical transparency in the visible range while maintaining lower sheet resistance, highlighting its potential as a transparent electrode material for flexible, and high-efficiency acoustic actuators. In the present work, PVDF films are obtained with ~350% of melt-stretching and d_{33}values between 20-25pC/N, indicates potential use for acoustic actuator application. Additionally, rGO-based conducting electrodes are coated on PVDF films by dip coating method exhibits optimum transparency and sheet resistance less than 50kΩ/□. This transparent thin film based acoustic actuators can be employed on windows, computer screens and touch panels to configure with Speaker-integrated devices. Also, it can be integrated in Active Noise Cancellation (ANC) systems that need compact and light weight acoustic actuators.

References

[1] M. Socol, N. Preda, A. Costas, A. Stanculescu, O. Rasoga, I. Stavarache, G. Popescu-Pelin, I. Toderascu, C. Breazu & G. Socol, Vacuum 233 (2025) 113943.
[2] E. S. Ege & A. Balikci, Actuators 12(7) (2023) 289.

Figures

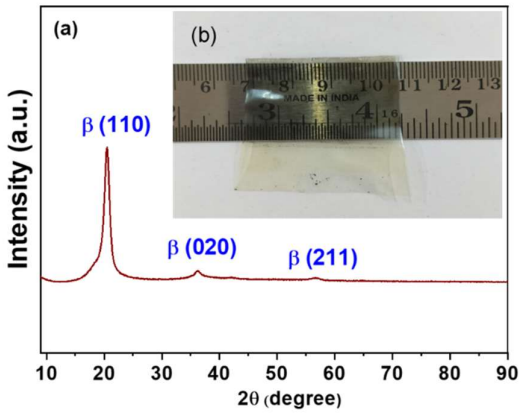

Figure 1: (a) XRD pattern of stretched and polled PVDF film. (b) Reduced graphene oxide based conducting electrodes coated on PVDF film.