INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Programme of Study	:	**Ph.D.**

Thesis Title: **FABRICATION AND TESTING OF PVDF BASED PENG DEVICES FOR IoT APPLICATIONS**

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SHORT ABSTRACT

Increasing environmental pollution and battery durability have redirected energy research toward eco-friendly renewable technologies. There is a pressing need to create energy conversion and power supply devices that are both high-performing and sustainable due to the rapid development of wearable electronics and the Internet of Things (IoT). The rapid development of polymer based flexible piezoelectric sensors have attracted considerable attention due to their promising applications in nanogenerators. PVDF thin films have a wide prospect in energy harvesting applications due to flexible design and presence of electroactive phase. Despite massive work in this domain, commercial applications are very rare since PVDF based thin films have low piezo response. Composite film samples are fabricated using DMF as a solvent through low cost solvent casting approach. This research work focuses on the fabrication and testing of flexible PENG devices made up of PVDF-based composites with enhanced mechanical, dielectric, and piezoelectric response for energy scavenging purposes. PVDF-TiO_2 composite films are fabricated to assess their piezoelectric performance for energy scavenging. Effect of varying rGO content on energy scavenging capacity of PVDF-TiO_2 composite films is then studied. Further, the MCDM-based TODIM technique is used to select the best piezoelectric material from the samples available. Role of reinforcement of rGO in PVDF-BTO composites for enhanced mechanical and piezoelectric performance is then studied. Further, naturally available bio-compatible filler materials are explored to develop sustainable piezoelectric energy harvesters. PVDF composites based on treated BMP are tested for their suitability as impact sensor under a variety of impact loading conditions. After that, PVDF-FS based bio based energy scavenging device interacting with human body parts to monitor real-time physiological signals is developed. The surface morphology, beta phase fraction, thermal stability, mechanical behaviour, and dielectric response of all the nanocomposite structures are examined. Conductive electrodes are deposited on the top and bottom surfaces of fabricated composite films to create a PENG device. The device is then put through a series of bio-mechanical operations, including tapping, thumb pressing, film twisting, and bending, to measure piezo response.These kind of flexible piezo devices prove to be ideal for mechanical energy harvesters used in sensing applications due to their excellent overall properties and good cost-performance balance.