Soft hybrid generators combining electroactive polymers for wearable applications

C. Jean-Mistral*[1] and Alain Sylvestre[2]

[1]LaMCoS – Institut National des Sciences Appliquées (INSA) - Lyon – France
[2]G2Elab – Université de Grenoble-Alpes, Université Grenoble Alpes – France

Résumé

Harvesting human kinetic energy with electroactive polymers and especially dielectric elastomer generators (DEG) is an innovative solution to supply low-consumption systems in sport or health monitoring applications. Indeed, dielectric elastomer are light, low cost, compliant and can develop a high scavenged energy density (0,8J.g-1) higher than piezoelectric polymers. Nevertheless, DEGs are soft electrostatic generators and need an external high bias voltage to perform energetic cycle. Thus, we have developed various concept of hybrid structures combining two electroactive polymers in order to remove the external high-voltage supply.Three kinds of innovative structures have been developed: the first employs electret, the second piezoelectric ceramic and the third one piezoelectric polymer as polarization element of a DEG. These solutions, compared to the ones proposed in the literature, present the advantages to be compact and do not need complex additional electronic element.Our first prototype scavenged an average output power of 85 μW theoretically and 33 μW experimentally under a strain of 50% at 1 Hz, corresponding to an experimental scavenged energy density of 0.55 mJ.g-1, and operated in 'electret mode', namely based on charges recombination between two electrodes through an external resistive load. Optimization have been done to reach the classic target of 100 μW, needed to supply low-consumption sensors. 'Dielectric mode' could be interesting if high polarization voltage can be generated. In this work, we will present our recent advances in this field of hybrid soft generators as well as a comparison in term of performances of our various structures.

Mots-Clés: hybrid structure, energy scavenging, electroactive polymer, dielectric polymer, electret, piezoelectric polymer

*Intervenant