Influence of Soft X-ray Radiation on Piezoelectric Property of Piezoelectret Films

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Introduction

Piezoelectrets are a new kind of piezoelectric polymer based on electret foams, whose strong piezoelectric activity normally comes from the synergistic effect of space charge electret and cellular structure in material [1-2]. Considering that piezoelectret films might be exposed to various radiation environments, including X-ray and ultraviolet ray irradiations, this work focuses on the piezoelectric attenuation characteristic of cross-linked cellular polypropylene (IXPP) and air-filled parallel-tunnel fluorinated ethylene propylene (FEP) piezoelectret films in soft X-ray radiation environment.

Results and discussion

After radiation by X-ray for 200 min, the quasi-static piezoelectric d_{33} coefficient for IXPP films decreased to 1% of the initial value, as indicated in Fig. 1(a). To alleviate the influence of soft X-ray radiation, encapsulation with silica gel is an effective method. As shown in Fig. 1(b), the charge storage behavior is improved a lot for silica gel encapsulated IXPP films.

For FEP films, only 1% of the initial quasi-static piezoelectric d_{33} coefficient retained after 120 min. What's more, short circuit connection will decelerate the decay in soft X-ray radiation environment, as shown in Fig. 1(c) and (d).

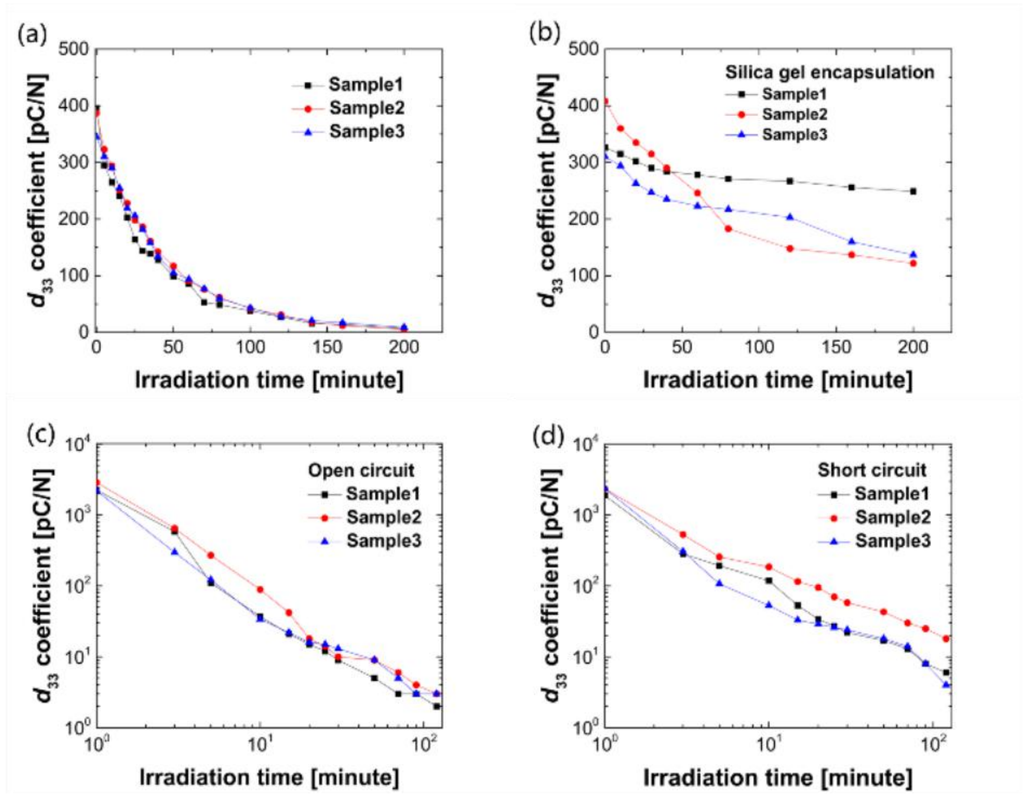

Figure 1: Decay curves: (a) IXPP films with direct soft X-ray irradiation. (b) IXPP films encapsulated with silica gel. (c) Open-circuited FEP films. (d) Short-circuited FEP films.

Conclusions

Soft X-ray can cause depolarization of cellular piezoelectrets that result from the discharge in air voids. And it demonstrated that effective encapsulation of the piezoelectret films can alleviate the depolarization process.

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References

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