

Acousto-electric properties of FEP/PTFE composite piezoelectret membrane



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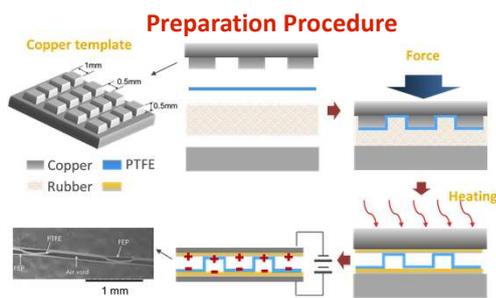
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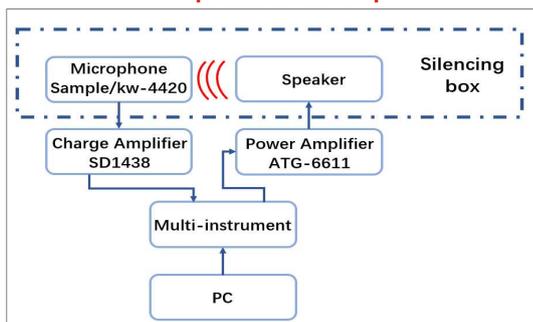
Introduction

Piezoelectrets (also known as ferroelectrets) are a kind of micro-porous electrets with strong piezoelectric effect [1-2]. Their typical characteristics are flexibility, low density and low characteristic acoustic impedance. Therefore, piezoelectrets are ideal materials for flexible air-coupled acoustoelectric transducers. In this paper, the electroacoustic performance of an electroacoustic transducer based on FEP / PTFE piezoelectret film is reported. The results show that the maximum microphone sensitivity is 6.7 mV/Pa@1 kHz. And the response curve is flat in the whole audio frequency range. In the ultrasonic frequency band, the SPL of the transmitter can reach 80 dB in a wide bandwidth before resonance at a driving voltage of 300 V (Vpp).

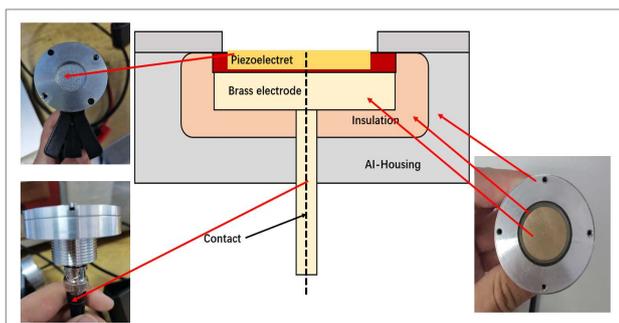
Experimental details



Experimental Setup

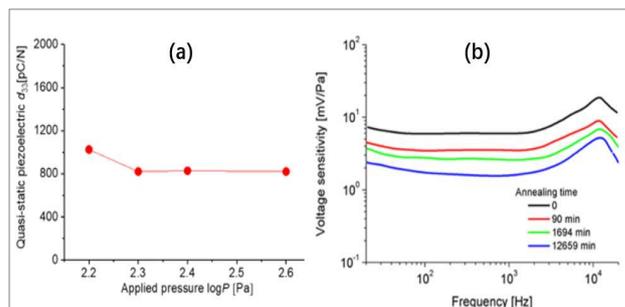


Sample Fixture



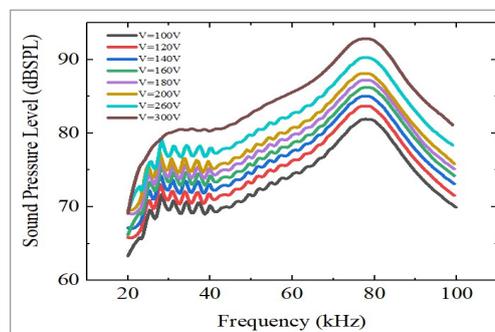
Results and discussion

Microphone Based on FEP / PTFE Piezoelectret



The resonant frequency of an acousto-electric transducer based on FEP/PTFE piezoelectric electret membrane is 78.5 kHz. The maximum microphone sensitivity is 6.7 mV/Pa@1 kHz and the response curve is flat over the entire audio range. The thermal stability of the device is significantly better than that of the polypropylene (PP) piezoelectret transducer.

Ultrasonic Transmitter Based on FEP / PTFE Piezoelectret



In the ultrasonic band, the loudest pressure level of the transmitter can reach 93 dB SPL at resonance frequency.

Conclusions

The FEP/PTFE composite piezoelectret has improved thermal stability, enhanced d_{33} coefficient and good pressure characteristics in a small pressure range. The acousto-electric transducer based on such film exhibits a high sensitivity up to 6.7 mV/Pa @1 kHz. The emission sensitivity can reach 80 dB at 40 kHz and 93 dB at resonance frequency of 80 kHz as driven by a voltage of 300 V (Vpp).

Acknowledgments

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References

- [1] S. Bauer, R. Gerhard-Multhaupt, G.M. Sessler, Ferroelectrets: Soft electroactive foams for transducers, *Physics Today*, 57 (2004) 37-43.
- [2] Z. Sun, X. Zhang, Z. Xia, X. Qiu, W. Wirges, R. Gerhard, C. Zeng, C. Zhang, B. Wang, Polarization and piezoelectricity in polymer films with artificial void structure, *Applied Physics A*, 105 (2011) 197-205.