Investigating the Optimum Efficiency of Acoustoelectric Conversion Plate Devices

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Abstract

This study aims to develop the acoustoelectric conversion plate in terms of electromagnetic induction law to convert sound energy to electricity, where the developed apparatus is made of three parts, the thin film coil, the spring, and the high-intensity magnetic framework. In process, the thin film coil receives the injecting sound vibration in connection with the spring to cause the reciprocating motion between the coil and the high-intensity magnet, which yields the electromotive force (EMF). In this study, a pearl plate of length 95 mm, width 95 mm, and thickness 1.5 mm adhered with a PET film of thickness 0.08mm is built as the substrate plate due to it has good properties of light and elasticity. In connection with the substrate plate and the electric coil is the thin film coil. Experiments used the speaker with output frequencies of 30~156 Hz and sound power of 0.5 W (sound intensity 0.32 W/m^2, sound pressure level 115 dB) as the sound source. The sound energy is captured by the acoustoelectric conversion plate for working efficiency and optimization parameters analysis. The studied parameters content of diameter, turns, and width of electric coil as well as distance between high intensity magnet and coil. The results show that diameter 0.11 mm, turns 220, and width 3 mm of the electric coil, in connection with steel spring of diameter 0.2 mm while input sound is 30 Hz, receives the average output voltage of 0.57 V, the average output current of 5.46 mA, the average output power of 3.13 mW, and the sound electric conversion efficiency of 0.63%. This innovation device could be used in highway, near waterfalls, and some high noise factories to capture energy for immediately charging cell-phone to save human life.

Keyword: electromagnetic induction, acoustoelectric conversion plate, spring, thin film coil, LabVIEW, sound power

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