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Temperature Field Analysis for ZnO Thin-Film Pyroelectric Devices with Partially Covered Electrode

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In this study, a finite element modeling is applied to simulate the temperature field of multilayer ZnO pyroelectric devices. The results show that alterations to the electrode width to improve the temperature variation rate are more successful when the ZnO film thickness is reduced. The marked improvement in the temperature variation rate in the ZnO layer of 200 nm thickness indicates a saturation rate of about 27% when the electrode width is approximately 1 μm. Furthermore, the optimal electrode width is reduced when the ZnO film thickness is decreased. Decreasing the ZnO film thickness clearly increases the temperature variation rate and reduces the response time; an electrode with the optimal width further enhances the temperature variation rate. Moreover, the temperature variation rate significantly decreases for thinner ZnO films when the electrode width is smaller than the optimal value. In addition, an experimental result is successful to verify the simulation results, and the electrode width is a critical parameter for designing a pyroelectric sensor.

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