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INTRODUCTION

Activity 4 showed you how PVDF's molecular structure contributes to its smart capabilities. Now you will investigate and measure the actual piezoelectric and pyroelectric responses of PVDF film.

Testing Piezoelectric Materials

Pyroelectric thermometer

You have probably held a thermometer under your tongue for several minutes to find out whether or not you had a fever. Did those minutes seem to take forever? Today, especially in hospitals, you can have your temperature taken in a matter of seconds with a pyroelectric thermometer. These devices employ a piezoelectric polymer similar to PVDF. The thermometer goes in your ear, just for a moment. The sensor material at the end of the thermometer sends a signal to a display that shows your temperature.

When PVDF film is distorted, it generates a voltage because electrical charges on its surface are rearranged. Such distortions, and the resulting voltage, indicate that the PVDF film has been stressed. A stress is an applied force. It is possible to tell how strong this force is from the amount of voltage the film generates.

PVDF is versatile. In response to pressure it has piezoelectric properties; in response to heat, it has pyroelectric properties (*pyro-* is a prefix meaning fire or heat). The new thermometer that makes taking a temperature so easy is a pyroelectric application of PVDF film.

CONCEPTS *behind* SMART SENSORS

The voltage a piezoelectric material generates in response to stress can be amplified and measured. Changes in voltage measurements can reflect changes in the type and amount of stress to which the material is responding.