

PIEZOELECTRIC SENSORS

Introduction

Some materials (certain crystals, for example) produce a charge when they are deflected; this is called a **piezoelectric effect**. Materials which exhibit this property are called **piezoelectric materials** or **piezo materials**. If a piezoelectric material is sandwiched between two conductors, or **electrodes**, a voltage difference is produced between the electrodes when the material is deflected. A typical arrangement is shown in Fig. 1 below.

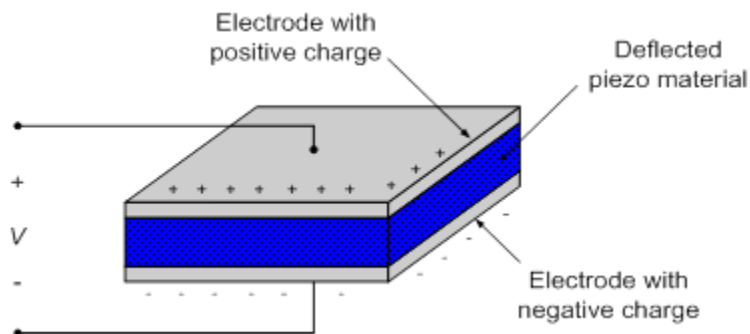


Figure 1. Arrangement of piezoelectric material between electrodes.

A constant (or **static**) deflection of a piezoelectric material will result in a fixed charge at the sensor's electrodes. **Leakage effects**, either within the piezoelectric material or the electronics associated with the sensor, cause this charge to dissipate with time.

Thus, piezoelectric sensors cannot generally be used for static measurements (measurement of constant values) since the sensor's output voltage will decay to zero if the piezoelectric material's deflection is constant. However, piezoelectric devices do make excellent **dynamic** sensors (sensors which record time-varying phenomena) in which the piezoelectric material deflects rapidly relative to the leakage rate.

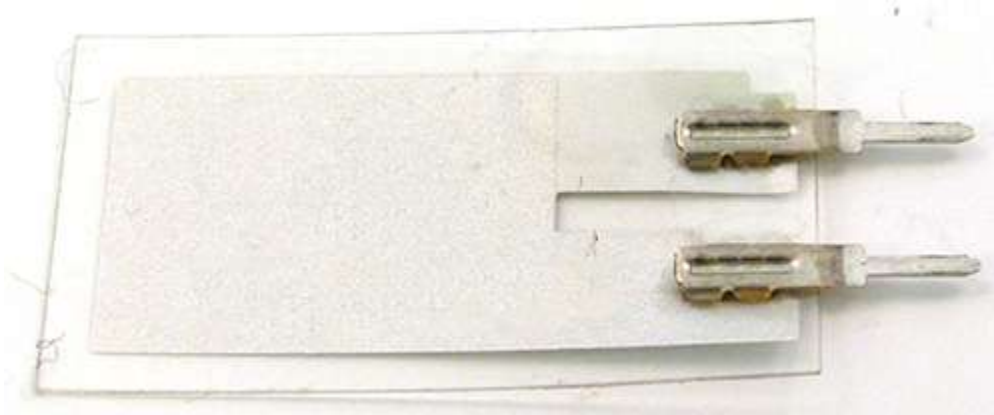


Figure 2. Piezoelectric sensor.

Piezoelectric sensors are often used in the measurement of time-varying pressures, accelerations, and forces. In these applications, the sensor is set up so that the process to be measured results in deflection of the piezoelectric material; the resulting voltage is used to indicate the desired physical parameter. A force applied to the material, for example, induces a stress in the material with a corresponding deformation of the material.

The piezoelectric sensor provided in the analog parts kit consists of a very thin piezoelectric film sandwiched between two printed electrodes and laminated to a polyester substrate. Contacts are provided to make connections to measure the response voltage. The device is shown in Fig. 2.