Piezoelectric Effect Encyclopedia Article

Piezoelectric Effect

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Piezoelectric Effect

Pierre Curie is probably best known for the research that he and his wife Marie Curie did on radioactivity, work that earned both the Nobel Prize. However, years before Pierre ever met Marie, he and his brother Jacques were famous internationally for their discovery of piezoelectricity.

Under certain conditions, some dielectric (electrically nonconducting) minerals, such as quartz and other asymmetric crystals, can conduct electricity. In 1880 the Curie brothers noted that certain crystals, when compressed or stretched, would create an electric charge that was in proportion to the amount of stress exerted on them. Most dramatic was the electric current created when quartz was squeezed. Through experimentation, the brothers also discovered that when a current was applied to certain faces of a quartz crystal, the crystal expanded, and it would vibrate when an alternating current was applied. They named this twofold phenomenon piezoelectricity, from the Greek word meaning "to press." The generating of electricity when under stress is known as direct piezoelectricity, while the mechanical distortion that takes place when a current is applied to a crystal is termed converse piezoelectricity. Piezoelectric crystals were first used in the quartz balance, which Pierre and Marie Curie employed extensively in their research.

The quartz balance was the first in what would be a long line of quartz-electric devices, including early radio transmitters. Piezoelectric crystals were used in the first sonar transducers (not surprising, since the inventor of sonar technology, Paul Langevin [1872-1946], worked for several years under the direction of Pierre Curie); the vibrating crystals can be used to create ultrasonic beams, the type necessary for sonar transmission and reception.

Today piezoelectric crystals can be found in microphones, hearing aids, telephone receivers, amplifiers, and just about any other sound-reproducing device, as well as in quartz watches.