Electret Encyclopedia Article

Electret

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Electret

The electret is an insulating material (a dielectric) that has the ability to hold an electrostatic charge, making it the electrostatic equivalent of a permanent magnet.

In 1919 Japanese scientist Mototaro Eguchi applied a high voltage to two electrodes that were immersed in a molten mixture of wax and resin. Keeping the voltage on, he allowed the mixture to solidify, creating a "frozen" polarization in the mixture between the electrodes. The dielectrics that are the electret come in two types. In a homocharge electret one side of the dielectric becomes positively charged, while the other side acquires a negative charge. In a heterocharge electret the positive and negative charges are aligned in the same direction within and throughout the material, but do not reach the electret's surface.

Electrets were first used by the Japanese in field telephones during World War II. In the United States and Great Britain, patents were taken out for their use in microphones, loudspeakers, voltmeters and electrometers. Most recently, homocharged electrets, which hold their charge longer, have been made with polymers in the form of a flexible film. The electret film forms a flexible diaphragm in a condenser microphone and can produce a wide, flat frequency response with low distortion without the need of an external polarizing voltage. These microphones are small and lightweight, insensitive to shock, and inexpensive.

The electret transducer is a device for the conversion of sound or motion into electrical energy using an electret. It has a flexible diaphragm that has been coated on one side with a thin metal film. A metal plate faces the uncoated side. Electrical leads are connected to both the film and plate. When the diaphragm moves it induces a charge on the metal plate, creating a flowing current. The current goes through the leads and into the amplifier input circuit where it produces a voltage which can be amplified.

Electret foil transducers have been used in a wide range of frequencies, from ultrasonic (up to 10^{8} Hz) to seismic (down to 10^{-3} Hz) detectors. They are also used in record players, hearing aids, earphones, and push-button keys on telephones and calculators. About 100 million electret microphones are produced annually for studio and home casette recorders.