Introduction - piezo in a nutshell

Materials have always had a large influence on society. This was obvious in the Stone Age, Bronze Age or Iron Age. We have named these eras by the most advanced material in that period, since these materials determine and limit the state of technology at the time.

Also in modern society, the influence of materials is still present. However, nowadays the materials as such are not as visible anymore as they used to be. They are more and more embedded in complex devices and high tech systems that make whole economies exist and function in an efficient way.

Piezoelectric materials are among these 'invisible' materials that are widespread around us, although they are unknown to the public at large. Mobile phones, automotive electronics, medical technology and industrial systems are only a few areas where 'piezo' is indispensable. Echos to capture the image of an unborn baby in a womb make use of piezo. Even in a parking sensor at the back of our car piezo is present.

What makes 'piezo' a phenomenon that can be applied so abundantly? Well, it is the nature of the material itself: it has the capability to change shape - for example become shorter or wider - by applying an electric voltage over it. This change in shape is not very big - generally in the micron range - but it occurs very fast, within milliseconds. Furthermore it is highly reproducible, and accurate in the nanometer range. Piezo also works the other way around: compressing or otherwise deforming the material generates an electric charge. So the piezo material is a smart system in itself.

Piezo stems from the ancient Greek πιέζειν (piezein), which means 'to press' or 'to squeeze'.

Piezoelectric actuators - devices that convert an electrical signal into an 'action' such as a physical displacement - play an important role in high tech systems, and also in high tech manufacturing technology. As do piezoelectric sensors - devices that convert a mechanical action into an electrical signal.

Due to the fact that piezoelectric materials are able to change in size very accurately, they can be found in various applications. Not only in inkjet printers, but also in loudspeakers, for example. Furthermore, since piezoelectric materials can position objects in an extremely accurate way, they are applied in scanning tunneling microscopes (STM) to keep the needle close to the sample, or in wafer steppers for making integrated circuits (ICs).

This book 'Applied Piezo' shows the huge variety of applications that rely on piezoelectricity. Maybe they will inspire you to use piezo materials in your own line of work. Have fun reading this book!