ENERGY GENERATION OF THE VIBRATION OSCILLATIONS. PIEZOELECTRIC EFFECT

Mantykova M.V.
Tomsk polytechnic university, Tomsk
Scientific advisor: Ivanova V.S., Ph.D., associate professor, department of precision instrument making

The problem of producing energy is very important nowadays. People are looking for the solution to this problem. Using the piezoelectric effect for generating energy is one of the solution.

As piezo energy harvesting has been studied only since the late 1990s [1], it remains a forming technology. Piezoelectricity is the electric charge that collects in certain solid materials (certain ceramics and crystals, and biological substance such as bone, DNA and various proteins) in reply to attached mechanical pressure. Piezoelectricity was opened in 1880 by French physicists Jacques and Pierre Curie. The piezoelectric effect is understood as the linear electromechanical interaction among the mechanical and the electrical position crystalline materials with no inversion symmetry [2]. The piezoelectric effect is a convertible process in that materials demonstrating the straight piezoelectric effect (the internal creation of electrical charge resulting from an applied mechanical force) also show the reverse piezoelectric effect (the internal creation of a mechanical strain resulting from an attached electrical field). For example, lead zirconate titanate crystals will create quantifiable piezoelectricity when their static structure is distorted by about 0.1% of the genuine size. Versa, those same crystals will change about 0.1% of their static dimension when a foreign electric field is attached to the material. The reverse piezoelectric effect is applied in production of ultrasonic sound waves. Piezoelectricity is found in beneficial applications such as the manufacture and detection of sound, creation of high voltages, electronic frequency creation, microbalances, and ultrafine focusing of optical assemblies. It is also the basis of a number of scientific instrumental techniques with atomic resolution, the scanning probe microscopies. Greatest piezoelectric electricity sources produce force on the order of milliwatts, too small for systems apply, but enough for hand-held unit such as some commercially affordable self-winding wristwatches. One suggestion is that they are used for micro-scale devices, such as in a device harvesting micro-hydraulic energy.

Crystals which acquire a charge when compressed, stranded or deformed are said to be piezoelectric. This provides a either transducer effect between mechanical and electrical oscillations. The generation of an electric load in some non-conducting substance, similar as quartz crystals and ceramics, once they are subjected to mechanical stress, or the creation of oscillation such materials when they are subjected to an electric field. Piezoelectric materials exhibited to a quite constant electric area tend to oscillation at a precise frequency with very little variation. Essence of the piezoelectric effect closely related to the emergence of electric dipole moments in solids. Of definitive importance for the piezoelectric effect is the change of polarization when using a mechanical stress. It can be any triggered by a re-configuration of the dipole-inducing surrounding or by re-orientation of molecular dipole moments by the impact of the external stress. Piezoelectricity may then reveal in a variation of the polarization strength, it's or both, with the details depending on the orientation of P within the crystal, crystal proportionally and the applied mechanical pressure. The change in appears as a variation of surface charge density on the crystal , i.e. as a variation of the electrical field extending between the faces caused by a change in dipole density in the volume. For example, a 1 cm3 cube of quartz with 2 kN of competently attached force can generate voltage of 12 kV[3]. Piezoelectric materials too show the contrary effect, named converse piezoelectric effect, where the use of an electrical field creates mechanical deformation in the crystal.

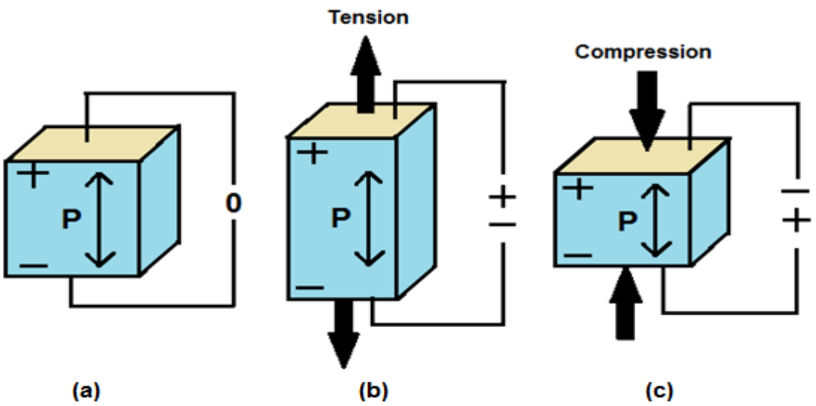

Fig. 1. Generation of piezoelectricity.

Fig. 1 shows conversion of vibration/ mechanical energy in electrical energy and versa. The straight effect generates an electrical charge when a mechanical oscillation or blow is applied to the material, while the reverse effect creates a mechanical vibration or shock when electricity is applied. All spatially divided charge will implication in an electric field, and thus an electric potential. In a piezoelectric device, mechanical stress, rather of a visually applied voltage, causes the charge division in the individual atoms of the material. Fig. 2 indicates generation of piezoelectricity. For polar crystals, for P≠0 holds without using a mechanical load, the piezoelectric effect emerge itself by changing the magnitude or the orientation of P or both. For the non-polar, but piezoelectric crystals, on the other, a polarization P various from zero is only discovered by using a mechanical load. For them the stress can be imagined to convert the material from a non-polar crystal class (P=0) to a polar one , having P≠0 [4]. Fig. 3 shows mechanism of piezoelectric effect in quartz.

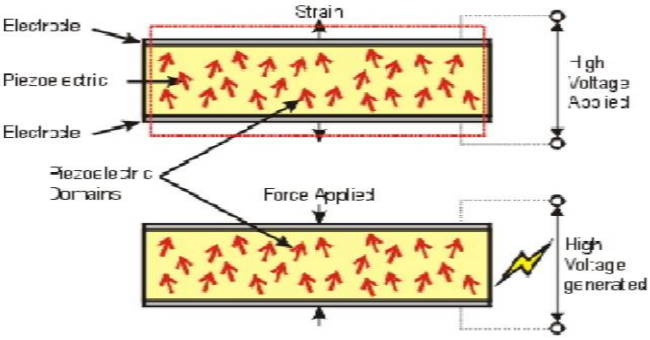

Fig. 2. Generation of piezoelectricity

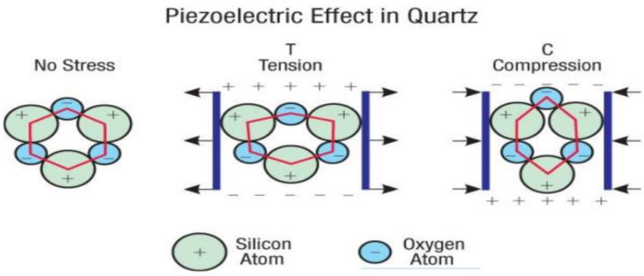

Fig. 3. Piezoeffect in quartz

In conclusion piezoelectric materials have the ability to transform mechanical strain energy into electrical charge. The sum of energy generated relies on the number of passing vehicles and the number of piezoelectric elements on the automobile way. Vehicles that are moving slowly appears to produce slightly more energy than faster – moving vehicles, but future research is needed to reaffirm this piezoelectric power generation system works successfully. It has tremendous scope for future energy solution towards sustainability.

References

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THE APPLICATION OF OSCILLATING SYSTEM TO RESEARCH OF PROCESS OF RED BLOOD CELL AGGREGATION IN MICROSCOPIC VOLUME SYSTEMS

Nefedova N.S.
Tomsk Polytechnic University, Russia, Tomsk
Scientific Supervisor: Aristov A.A. associate professor, Ph.D.

Scientists have always been interested in rheological properties of blood. This interest stems from the fact that a large number of diseases caused due to changes in the composition and biophysical properties. Red blood cells consist 98% of the total volume of formed elements of blood and determine the rheological parameters of blood. Hemorheological disorders are of great importance in the pathogenesis of many diseases. Aggregation of red blood cells is the ability of RBCs to form "coin bars", the shape of which depends on the normal or pathological conditions [1]. The nature and process indicators aggregation of erythrocytes can be concluded about the health of the patient.

Photometric methods are used most often to study the process of aggregation. Photometric registration method based on measuring the intensity of the light flux, which receivelets blood in the process of growth units, after the termination of stirring of the test specimen in special cells [2]. A large blood volume, e.g. 1 ml or more are used in modern aggregometers. The task of developing devices with the use of small volumes of blood is relevant at the moment. Therefore, one of the objectives when designing the device for the study of the aggregation with the use of