Multi Bio Ultra Sounds Stimulation Application

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Single crystal quartz developed 1880 to 1950 was the 1st generation piezoelectric material. Perovskite structure of $BaTiO_3$ and $Pb(Zr,Ti)O_3$ ceramics discovered in 1940 to 1960 were the 2nd generation piezoelectric material. These two materials developed a huge market of dielectric capacitors and sonar, buzzer and various types of transducers applications. Perovskite relaxor single crystals, $Pb(Me,Nb)O_3$-$PbTiO_3$, (Me=Mg, Zn, In), discovered in 1980 to 2013 were the 3rd generation piezoelectric material. These materials have used for a high-end medical ultrasonic (US) diagnostic equipment and sonar applications. The world-highest piezoelectric constant of d_{33}=3930 pC/N of the relaxor based single crystal was developed by a smart composition design and poling process. However, author think that there is no innovative inorganic piezoelectric material beyond these 1st 2nd and 3rd generation materials and applications. And now is the best timing to find a new generation piezoelectric materials and/or applications. Multi-Bio-Ultra-Sounds (MBUS), a new concept of combining biotechnology and sonic and US stimulation (SUSS) is demonstrated as 4th generation piezoelectric and US application. The research concept is based on induced piezoelectricity by a diversity of multi-frequencies of low-intensity pulse SUSS of all living cells and matters. A compact size, less than 1,500cc and 1kg, of the MBUS SUSS equipment was developed and the first clinical trial was studied for an osteoarthritis (OA) patient of 64 years senior amateur soccer player. In this talk the MBUS SUSS equipment design, materials, functions, method, and the therapy result for the OA patient are introduced. This equipment suggests a new therapy and prevention method of (OA) and Osteoporosis (OP) bone diseases of elder people in the near future. The MBUS SUSS technology may contribute to the development of new applications of piezoelectricity, US, and biotechnology, and it could help to solve world food shortage and realize a new medical therapy and prevention method in the near future.