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## Piezo-Material Characterisation for Focus Ultrasound Surgery with Temperature-Dependent Electrical Impedance Spectrum

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High Intensity Focused Ultrasound (HIFU) is gathering increasing interests as a developing surgical techniques for targeted malignancy treatments. It is a truly non-invasive approach which will only induce necrosis by thermal ablation effects within its focal area, deep-seated in human body. To further develop this techniques, a comprehensive understanding of the performance of ultrasound sources during operation process is required, including piezo-electrical material behaviour as a fundamental research.

HIFU therapeutic transducers usually need to withstand high power drive conditions associated with self-heating issue, which will affect the performance of transducers. Two types of material: PZ54 piezoceramic and PMN-PT single crystal, were introduced to HIFU application. PZ54 was specifically developed for ultrasonic assisted surgery and therapeutics, which has high permittivities, high mechanical values and low dielectric losses. PMN-PT single crystal is more sensitive to environment conditions however it can offer the potential for much higher performance than ceramic.

In this work, standard characterisation techniques based on resonances characteristics measured with electrical impedance spectroscopy were applied, and these two materials were investigated and their material properties were analysed under elevated temperature condition, which covers the operating envelope found in focused ultrasound surgery application. The variations with temperature in both impedance spectroscopy and material key parameters will be presented.