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***Smart Materials and MEMS Applications: from Neural Interfaces to PiezoMEMS***

**Synopsis:**

Microelectromechanical Systems (MEMS) are widely used in everyday applications, such as telecommunications (RF filters), accelerometers, gyroscopes, microphones, ultrasound, and numerous other applications. MEMS research continues to be an area of interest, both academically and in industry. Research into enhancing device performance, reliability, and new fabrication techniques continue to be the main focus, while new applications are being discovered. This talk will give a high-level overview of specific MEMS applications that the speaker has targeted over the last decade, ranging from movable thermal-actuated MEMS implantable microelectrodes, to PiezoMEMS with particular interest in energy harvesting for IoT and leadless pacemakers, drug delivery devices, and acoustic resonators.

The talk will highlight key advances, including the development and enhancement of thin film piezoelectric material Aluminum Nitride (AlN), which is the functional material in the applications described. AlN is a CMOS and biocompatible material which has recently been deposited on flexible substrates, making it ideal for BioMEMS applications. Combining AlN with MEMS fabrication has started a new platform technology that has led to advances in various applications, including high power density MEMS vibrational energy harvesters (2.5 mW/cm3), ultra-efficient (80%) drug delivery through aerosol generation, and high Q-factor acoustic resonators. Over the next two decades AlN is believed to be the one of the most influential smart materials. Enhancement of the material will continue and its use in various MEMS applications will expand.