

# Piezoelectric Films for Microelectromechanical Systems

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Piezoelectric thin films are of increasing interest in low voltage microelectromechanical systems (MEMS) for sensing, actuation, and energy harvesting. They also serve as model systems to study fundamental behavior in piezoelectrics. The seminar will discuss how materials are optimized for these applications, as well as examples of the use of piezoelectric films over a wide range of length scales. The key figures of merit for actuators and energy harvesting will be discussed, with emphasis on how to achieve these on practical substrates. For example, control of the domain structure of the ferroelectric material allows the energy harvesting figure of merit for the piezoelectric layer to be increased by factors of 4 – 10. Likewise, control of crystallographic orientation and substrate clamping enables large increases in the figure of merit for actuators. To illustrate the functionality of these films, examples of integration into MEMS structures will also be discussed, including adaptive optics for X-ray telescopes, low frequency and non-resonant piezoelectric energy harvesting devices, and piezoelectronic transistors as a potential replacement for CMOS electronics.

