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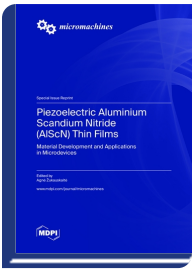
Special Issue Reprint

Piezoelectric Aluminium Scandium Nitride (AlScN) Thin Films: Material Development and Applications in Microdevices



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Recently, aluminium scandium nitride (AlScN) emerged as a material with superior properties compared to aluminium nitride (AlN). Substituting Al with Sc in AlN leads to a dramatic increase in the piezoelectric coefficient as well as in electromechanical coupling. This discovery finally allowed us to overcome the limitations of AlN thin films in various piezoelectric applications while still enabling us to benefit from all of the advantages of the parent material system, such as a high temperature stability, CMOS compatibility, and good mechanical properties. Potential applications include RF filters (bulk acoustic wave (BAW) or surface acoustic wave (SAW) resonators), energy harvesting, sensing applications, and infrared detectors. The recent progress in MOCVD- and MBE-grown AlScN has led to high-frequency and -power electronics, (high-electron-mobility transistors (HEMTs)). AlScN is the first wurtzite III-nitride where ferroelectric switching was observed, allowing for many new possible applications in semiconductor memories additionally, it enables the additional functionality of switching to applications where piezoelectric materials are already in use. This Special Issue was very successful in covering all of the main aspects of AlScN research, including its growth, the fundamental and application-relevant properties, and device fabrication and characterization. We can see that AlScN technology is mature enough to be utilized in wafer-level material development and complicated devices, but there is still much to discover in terms of deposition process control, anisotropy, and, in particular, ferroelectric behavior.

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