ALD oxides towards LED improvement

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Inorganic barrier materials are most important component for microelectronics and LED-technology when device finishing is considered. Activities targeting new layers and new materials, but also technologies provide vast options for industrials and researchers. The most popular materials up-to-date are the silicon oxides/nitrides and aluminium oxides, and the technologies – plasma enhanced chemical vapour deposition and atomic layer deposition (ALD). Still challenges remain in anticipation whether the barrier layers fulfilling simultaneously a complex of requirements for current spreading, passivation, light extraction, encapsulation stay chemically stabile within the process flow of LED manufacturing.

In this work, a series of niobium, titanium, hafnium, yttrium, tantalum, zirconium ALD oxide layers on silicon and GaN substrate were deposited and investigated. Thermal and electrical stability, the key issues in device manufacturing procedure, were addressed when executing structural, optical, electrical investigations. The analysis of oxide layer surface morphology was correlated with the phase transformation leading to a quite selective crystallization kinetic depended on the material and on the deposition conditions. C-V measurements revealed information about the charge trapping at the oxide-substrate interface, in some case also permanent. A comparative study on the variety of oxides deposited and investigated on the same trail will be presented.

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