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Tunable ion flux density and its impact on AlN thin films deposited in a confocal DC Magnetron Sputtering System

Mathis Trant, Maria Fischer, Kerstin Thorwarth, Hans Hug, Jörg Patscheider

Empa, Dübendorf, Switzerland

mathis.trant@empa.ch

Ion bombardment during deposition is known to have a great influence on many thin film properties such as stress states and growth morphology. In the present work the effect of a variable magnetic field generated by electromagnetic coils on the plasma parameters in a confocal dc magnetron co-sputtering system are studied, together with the impact on aluminum nitride (AlN) thin film properties.
An increase of the ion current density by more than one order of magnitude could be achieved with the help of the electromagnetic coils. Selected plasma parameters are measured as a function of the magnetic field strength for both the open and the closed magnetic field configuration. Because of its symmetric geometry the open field configuration provides roughly double the ion current density when averaged over the entire sample holder.
AlN nitride thin films deposited under various plasma conditions show striking differences in stress states, growth morphology and crystalline texture. By increasing the bombardment the residual stress in the films could be varied from tensile to compressive. This goes along with a change from columnar growth morphology towards more dense films. Highly (002) oriented films could be grown at room temperature, while without the additional ion bombardment a more complex crystalline texture is obtained.

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