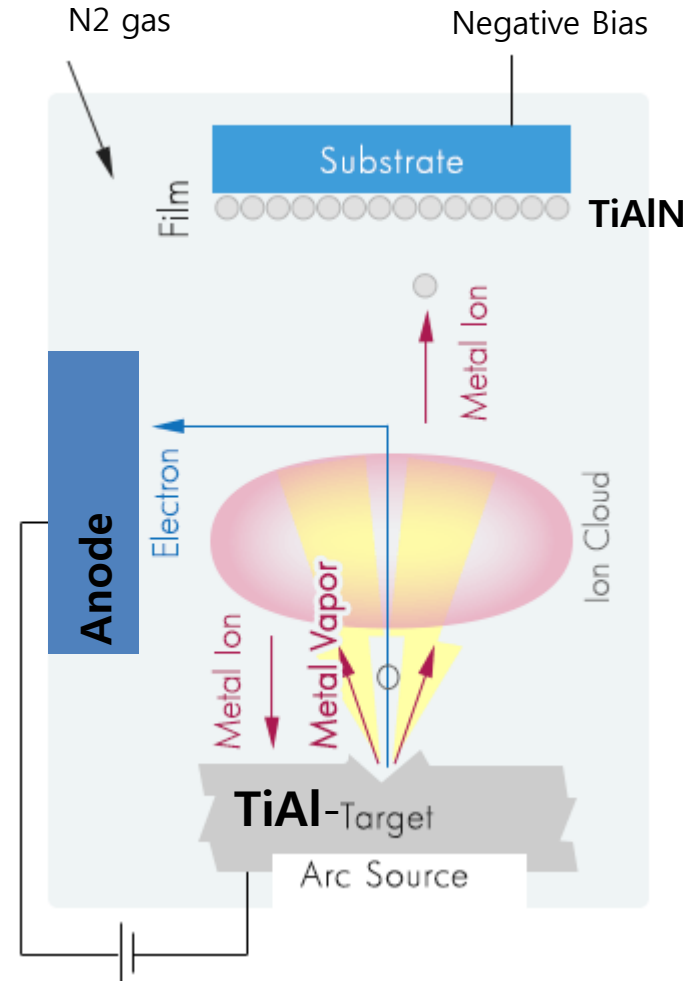
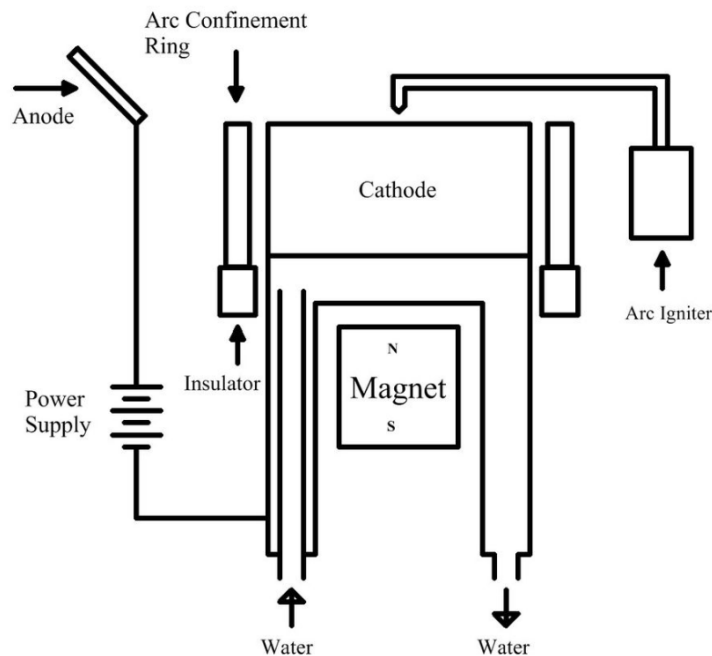


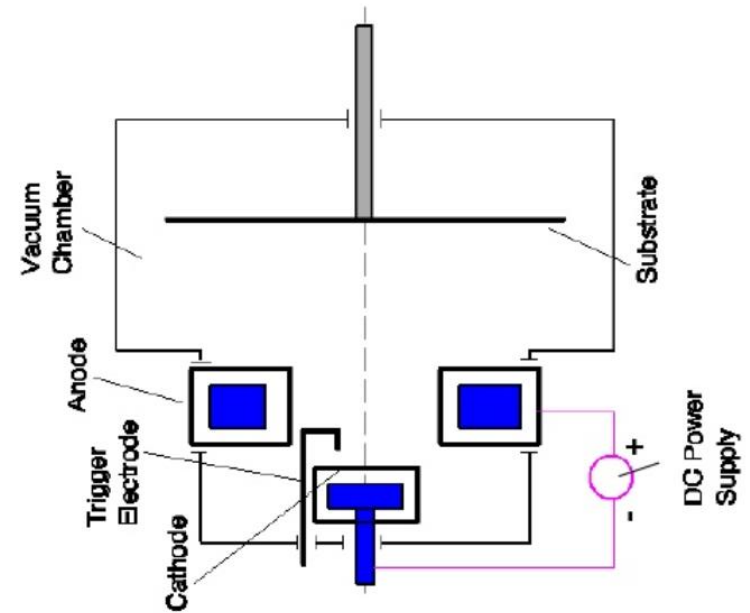
금속 이온빔 공정 : Arc Ion Plating(AIP) for TiAlN Deposition

- Evacuate process chamber and introduce nitrogen gas.
- Generate arc discharge on the surface of metal target.
- Evaporate target metals ionized by the arc discharge.
- Apply negative voltage on substrate to attract ions reacting with nitrogen gas.
- Metal nitride deposits on substrate.

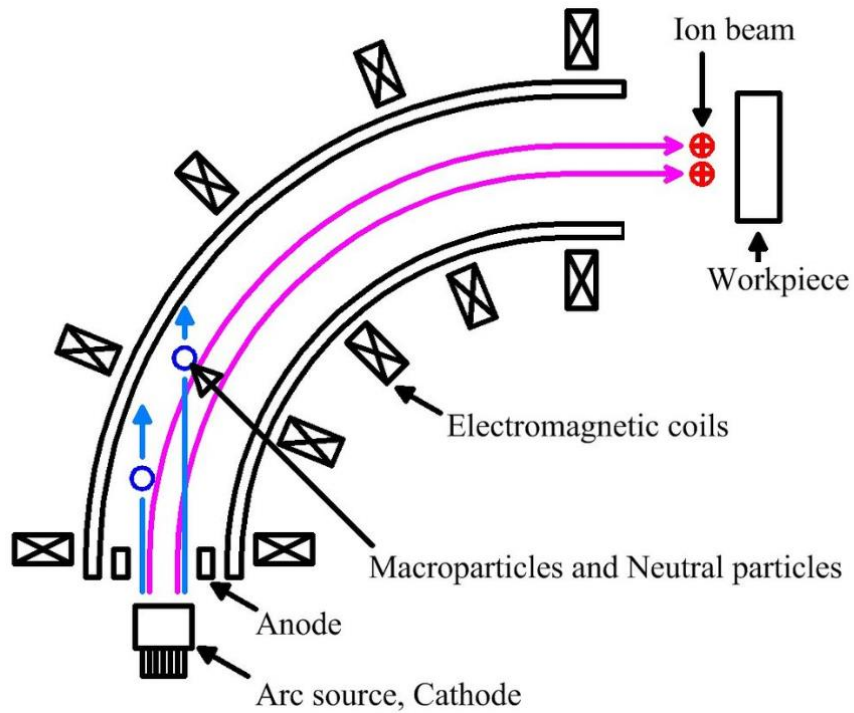


Magnetron Sputtering Vs. AIP

FEATURE	VACUUM ARC	SPUTTERING
Type of plasma	Metal (mainly) plasma, cathode erosion species	Glow discharge induced in low pressure background working gas
Function of plasma	Production of charged particle jet to be deposited on substrate	Bombardment by of target by plasma ions to eject particles (atoms/molecules) of material to be deposited
Electrical characteristics	High current ($I_{arc}=30-500\text{ A}$), low voltage (10-50 V) discharge	High voltage (few hundreds V - $\sim 1\text{ kV}$), low current ($\sim 10^{-2}-1\text{ A}$) ₂₀ discharge

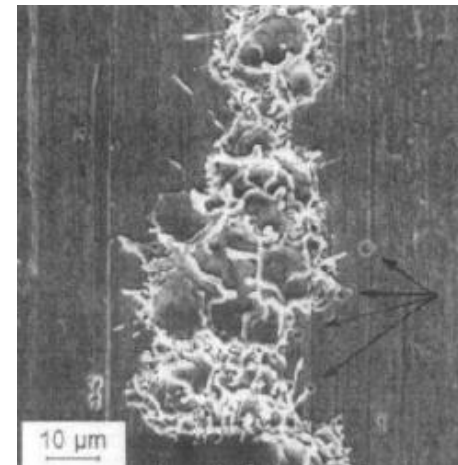
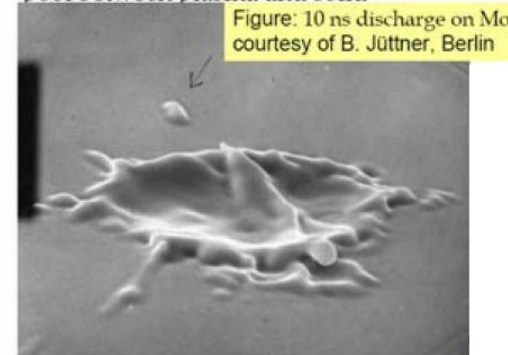


- ❑ *Water-cooled cylindrical cathode of conducting material*
- ❑ *Water-cooled annular anode*
- ❑ *Trigger mechanism*
- ❑ *High current, low voltage DC power supply (dc welding power supply is suitable)*



Macroparticles formation

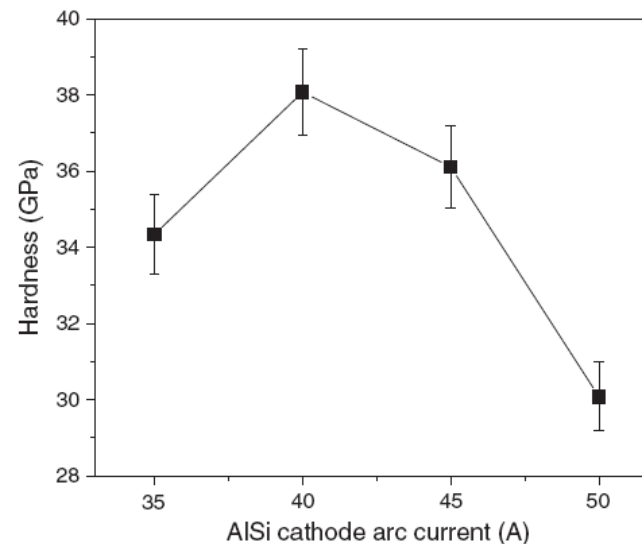
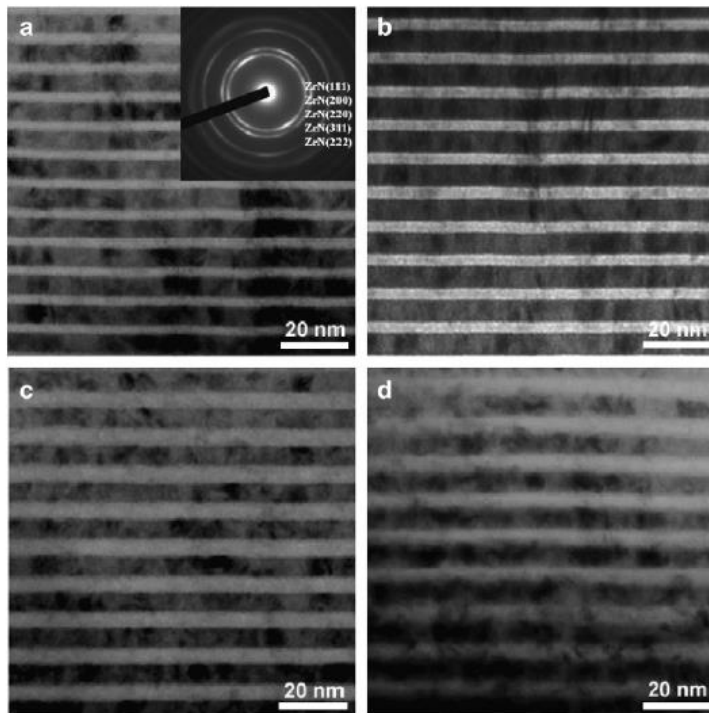
- Macroparticles are formed as part of the explosive plasma formation
- Typical: Material is ejected from the liquid pool between plasma and solid



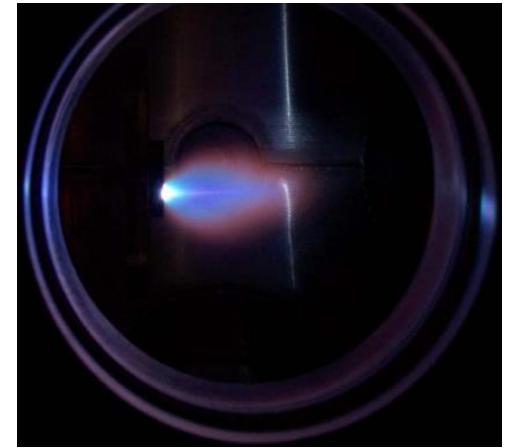
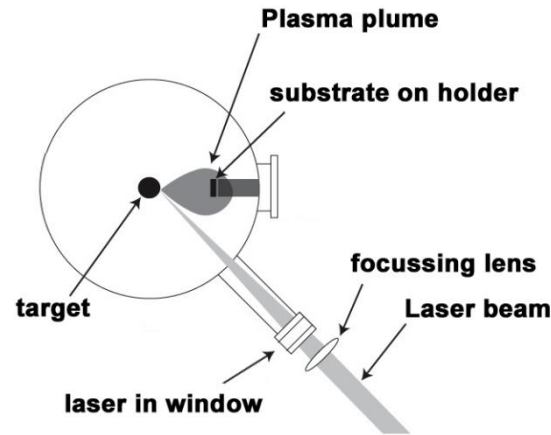
Cathodic arc plasma deposition of nano-multilayered ZrN/AlSiN thin films

Surface & Coatings Technology 206 (2011) 1507–1510

Thin films of ZrN/AlSiN were deposited on SKD 11 tool steel substrate using Zr and AlSi cathodes in an Ar/N₂ gas mixture in a cathodic arc plasma deposition system. The influence of the AlSi cathode arc current and the substrate bias voltage on the mechanical and structural properties of the films was investigated. X-ray diffraction, electron probe micro-analysis, high resolution transmission electron microscopy, nanoindentation and profilometry were used to characterize the films. The ZrN/AlSiN thin films had a multilayered structure by rotating the substrate in which nano-crystalline ZrN layers alternated with amorphous AlSiN layers. The hardness of the films increased as the AlSi cathode arc current was raised from 35 to 40 A, and then decreased with a further increase of the current. The hardness of the films increased with the increase of the bias voltage from -50 to -100 V. Further increase in the bias voltage decreased the hardness. The films exhibited a maximum hardness of 38 GPa. With the increase of bias voltage, the residual stress of the films correlated well with the hardness.



PVD Laser deposition system



Pulsed laser deposition(PLD) :

a physical vapor deposition technique where a high power pulsed laser beam is focused to strike a target of the desired composition. Material is vaporized and deposited as a thin film on a substrate facing the target. This process can occur in ultra high vacuum or in the presence of a background gas, such as oxygen when depositing films of oxides.

- A laser beam vaporizes a target surface, producing a film with the **same composition as the target**.
- Many materials can be deposited in a wide variety of gases over a broad range of gas pressures.
- One laser can serve many vacuum systems.
- High quality films can be grown in 10 or 15 minutes.