Monoclinic Optical Properties of Slanted Columnar Thin Films

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Our Message

- Glancing angle deposition is utilized to grow slanted columnar thin films (SCTFs) from metal
- Generalized ellipsometry is used to determine optical and structural properties of such highly anisotropic films
- Each SCTF has two pseudo-isotropic orientations (c-axis || plane of incidence)
- SCTFs have monoclinic optical constants that differ drastically from their bulk material
- SCTFs composed of different materials, but similar morphology, have similar optical properties
- Optical properties of SCTFs are rather determined by morphology than material

Glancing Angle Deposition

- The incoming particle flux at glancing angle causes self-organized columnar growth due to preferential growth of nucleation sites, structure shadowing, and limited surface adatom movement.

Optical Properties of Slanted Columnar Thin Films

Overview

Titanium

- Thickness d = 178.9 nm ± 196 nm
- Inclination θ = 46.7° ± 47°
- Angle β = 67° ± ---


Chromium

- Thickness d = 150.4 nm ± 161 nm
- Inclination θ = 45.2° ± 46°
- Angle β = 74.8° ± ---


Cobalt

- Thickness d = 113.4 nm ± 125 nm
- Inclination θ = 55.3° ± 55°
- Angle β = 80.6° ± ---


Mueller Matrix Data (λ = 850 nm)

Optical Constants n and k

Wavelength Dependency M14

Model and Theory

Variable parameters in Biaxial Layer
- d: thickness
- θ: in-plane orientation
- β: tilting angle
- γ: monoclinic angle
- Ψ along principal axes a, b, c

Monoclinic Angle γ

Specific arrangement
- Tilt overall dipole moment towards the surface normal

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