

Sputter Deposited Coatings for Mid- and High- Temperature Solar Selective Applications

Requirements of a High Temperature Solar Absorber:

- High α (>0.90)
- Low ϵ (e.g., <0.07 on Cu)
- Long term stability at higher temperatures (>450°C)

Sputter Deposited High Temperature Solar Selective Coatings Developed at NAL

Coating	α	ϵ	Thermal stability*
TiAlN/TiAlON/Si ₃ N ₄	0.939	0.06	550°C
TiAlN/AlON	0.933	0.05	550°C
NbAlN/NbAlON/Si ₃ N ₄	0.951	0.07	500°C
TiAlN/CrAlON/Si ₃ N ₄	0.944	0.07	500°C

Other Sputter Deposited Solar Selective Coatings: For Low- and Mid- Temperature Applications

Cr _x O _y /Cr/Cr ₂ O ₃	0.909	0.05	325°C
Al _x O _y /Al/Al ₂ O ₃	0.962	0.07	400°C
HfO _x /Mo/HfO ₂	0.917	0.07	400°C
Ag-Al ₂ O ₃ #	0.920	0.05	-

*In air for 2 hrs

#Nanocermet

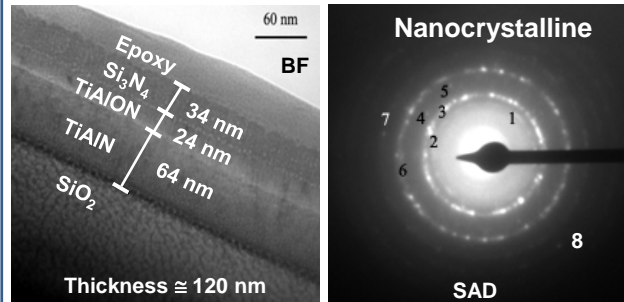
Deposition Process: Reactive DC Magnetron Sputtering



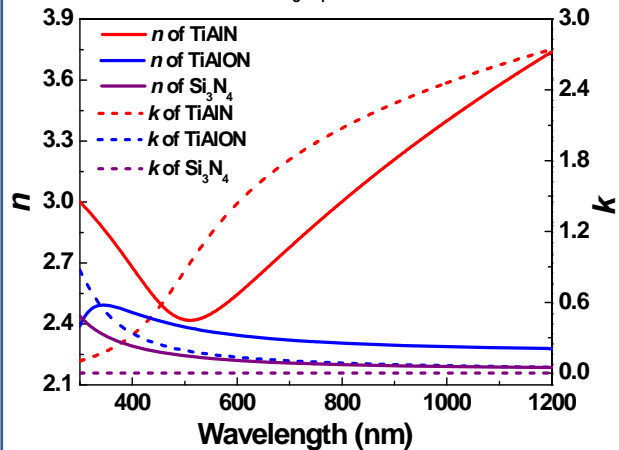
The TiAlN/TiAlON/Si₃N₄ Tandem Absorber

Salient Features:

- Uses nitrides and oxy-nitrides of transition metals
- Compositionally stable at higher temperatures
- Gradient refractive indices
- First of its kind ([US Patent #7,585,568B2, 2009](#))
- Ideal coating for solar thermal power generation



XTEM micrograph and SAD pattern of a typical TiAlN/TiAlON/Si₃N₄ tandem absorber



'n' and 'k' of TiAlN, TiAlON and Si₃N₄ layers in the TiAlN/TiAlON/Si₃N₄ tandem absorber



Sputter deposited TiAlN/TiAlON solar selective coating on 6" stainless steel tube

TiAlN/TiAlON/Si₃N₄ tandem absorber on Cu substrate exhibits:

Thermal Stability: (a) 525°C for 50 hrs in air; (b) 700°C for 3 hrs in vacuum

Upscaling – Industry Participation Solicited



Contact: Head, Surface Engineering Division
National Aerospace Laboratories (CSIR), Bangalore – 560017, India
Tel: +91-80-2508 6247, Fax: +91-80-2521 0113

