LabForInvention

Simulations and Experiments on Ag-Ti Alloy Optical properties and Window Coating Applications

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Introduction

- Silver-based and TiN based thin film glass coatings with thicknesses of tens of nanometers are widely used in today's energy-efficient building windows.
- However, there are no reports on Ag-Ti alloy thin film coatings for optical coating applications.
- In this presentation
  - Explore the optical properties of Ag-Ti alloys
  - Design the products of their optical application
  - Generate and characterize an energy efficient window proto-type product
  - Design new energy efficient window coatings

Why the new materials AgTi was selected

Ag and Ti are common metal materials for energy saving window coating, but there is no AgTi alloy in energy saving coating, and there are no such literatures on those materials for optical coatings

We may be the first to explore this new materials AgTi optical properties and their applications

Experimental Setup

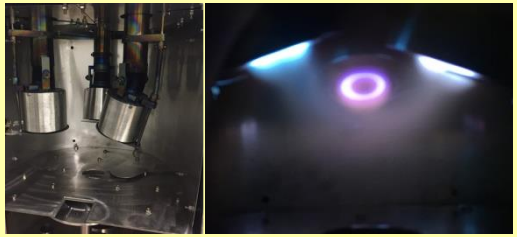
Nano-thin Film Research, World Class Facilities



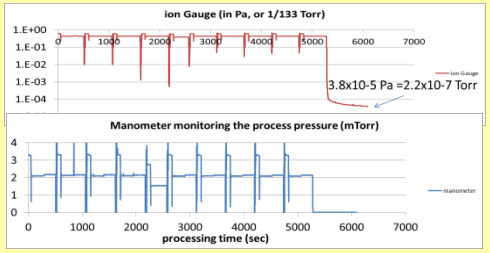
Friendly Operation Interface



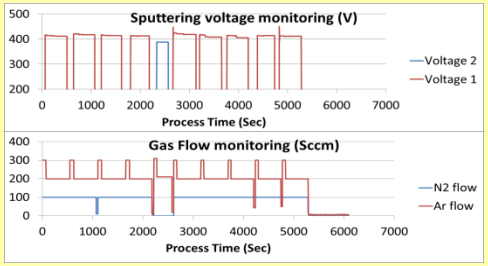
Thin film & new materials, products developments



Excellent background vacuum 1.6x10^{-7}Torr (2.1x10^{-5} Pa)



Stable process, with 2hr running multiple steps / cycles



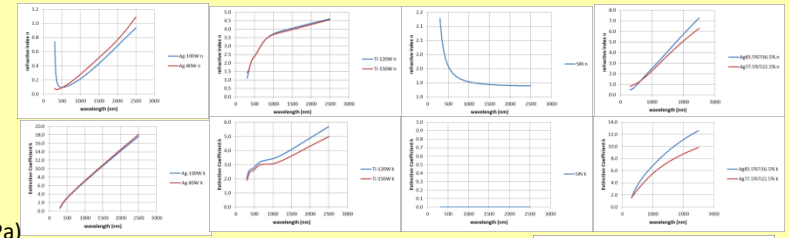
World class metrology tools



Famous Woollam Spectroscopic Ellipsometer: Top brand UV-Vis-IR spectrometer: Four point probe

Experimental results

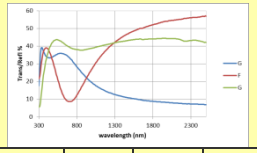
Silver thin film characterization | Titanium thin film characterization | Transparent Dielectric film SiN | New materials AgTi



New materials AgTi in a stack for energy saving window coating

72 nm Si3N4
17.5nm Ag alloys
12nm Si3N4
Glass

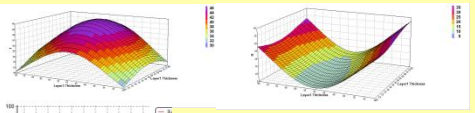




Tvis	Rvis	Tsol	Rsol	Asol	SHGC	SC	LSG	Uval
32.9%	44.1%	24.1%	40.8%	35.1%	0.275	0.316	1.2	0.329

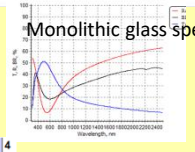
simulation

Layer 3 SiN
17.5nm Ag alloys
layer 1 SiN
Glass

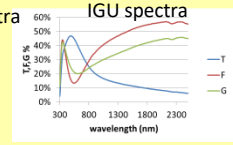


Optimization results

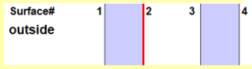
55 nm Si3N4
17.5nm AgTi
53nm Si3N4
Glass



Monolithic glass spectra



IGU spectra



16mm gap with Ar gas

Tvis	Rvis	Tsol	Rsol	Asol	SHGC	SC	LSG	Uval
44.0%	21.6%	28.2%	28.0%	43.8%	0.325	0.374	1.35	0.329

Summary

- Glass coating could benefit energy saving for residential or commercial buildings.
- New research for the new materials AgTi was studied AgTi(85%/15%)
- The new materials optical properties are characterized. The n,k data may be the first published data for this material.
- A new proto-type product for energy saving window coating was generated with a good Tvis 44% and LSG 1.35 and neutral color, meeting market product requirements.