

Declaration

I, the undersigned, Corentin MONMEYRAN declare:

- I am currently an Engineer and Project Manager in the Processes and Exterior Coatings group in the Thin Films department at Saint-Gobain Research Paris, Aubervilliers, France.
- As such, I have several years of expertise on the constitution and deposition of thin layers on glazing with solar control properties.
- Within the framework of my functions, I have acquired a particular expertise in the field of thin films multilayer deposited on a glass substrate.

I certify the following, to the best of my knowledge:

I have been asked, in the context of the examination of the national patent applications originated from the PCT/FR2019/053151 patent application (publication number WO2020/128327), of which I am an inventor, to estimate the optical properties of various stacks of thin layers whose functional layer is titanium nitride, deposited on a 4 mm clear glass substrate and mentioned as relevant in the international search report.

These simulations are nowadays common in the field of thin film stacks deposited on a glass substrate and are based on a database accumulated by the company Saint-Gobain and a simulation program already proven for many years for its reliability, so that the results of the previous parameters obtained on the basis of such a simulation and as reported below can be considered as close to experimental results that would have been found for the glass in question, to the best of my knowledge.

Simulation 1 (from example cited from D2 : US5091244):

For this simulation, I used the data of table 10 and simulated the relevant optical properties of the described stack, namely :

Glass/SnO₂ (10nm)/TiN (22nm)/ SnO₂ (50nm)/TiN (12nm)/SiO₂(75nm)

Simulation 2 (from example cited from D2 : US5091244):

For this simulation, I used the data of table 10 and simulated the relevant optical properties of the described stack, but where the oxide dielectrics have been replaced by silicon nitride, as taught in column 14 of this publication.

The simulated stack is therefore :

Glass / Si₃N₄ (10nm) / TiN (22nm) / Si₃N₄ (50nm) /TiN (12nm) / Si₃N₄ (75nm)

Simulation 3 (from example cited from D3 : US5216542):

For this simulation, I used the data of D2 mentioned in the International Opinion on Patentability and simulated the relevant optical properties of the relevant stack, namely :

Glass / SnO₂ (17nm) / TiN (19nm) / SnO₂ (50nm) / TiN (13nm) / Al₂O₃(73nm)

Simulation 4 (from example cited from D3 : US5216542):

For this simulation, I used the same data as for simulation 3 and simulated the relevant optical properties of the same stack, but where the oxide dielectrics have been replaced by silicon nitride, as taught in column 14 of the D2 publication.

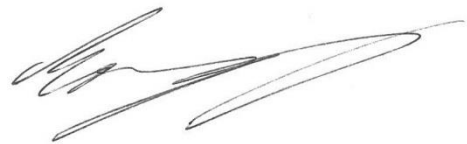
The simulated stack is therefore :

Glass / Si₃N₄ (17nm) / TiN (19nm) / Si₃N₄ (50nm) / TiN (13nm) / Si₃N₄ (73nm)

The results of my simulations are given in the table below:

Stack	T_L	R_{Lc}	$T_L - R_{Lc}$
Simulation 1	40.1	0.6	39.5
Simulation 2	27.8	14.3	13.5
Simulation 3	42.6	2.7	39.9
Simulation 4	30.6	13.4	17.2

Paris, January 31th, 2022.



Corentin MONMEYRAN