



HAL
open science

Process of obtention of titanium nitride by rapid thermal annealing

Victor Vallejo-Otero, Arnaud Valour, Stéphanie Reynaud, Christophe Donnet, Émilie Gamet, Nicolas Crespo-Monteiro, Yves Jourlin

► To cite this version:

Victor Vallejo-Otero, Arnaud Valour, Stéphanie Reynaud, Christophe Donnet, Émilie Gamet, et al.. Process of obtention of titanium nitride by rapid thermal annealing. ISNT: 11th International Symposium on Nitrides, May 2023, Saint-Malo (France), France. hal-04094503

HAL Id: hal-04094503

<https://hal.science/hal-04094503v1>

Submitted on 11 May 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Process of obtention of titanium nitride by rapid thermal annealing.

V. Vallejo-Otero¹, A. Valour¹, S. Reynaud¹, C. Donnet¹, E. Gamet¹, N. Crespo-Monteiro¹ et Y. Jourlin¹

¹ Hubert Curien Laboratory, University of Lyon, Saint-Etienne, FRANCE

The titanium nitride (TiN) is an interesting material for plasmonic dispositive and metasurfaces. It can replace gold and silver in visible and near infrared spectral regions. Furthermore, due to its high thermal, chemical and mechanical stability the titanium nitride is interesting for applications where gold and silver are not stable.

The TiN can be obtained thanks to a lot of different physical techniques such as the physical vapor deposition (PVD) or the ammonolysis of titanium oxide (TiO₂). Regarding the ammonolysis, the TiO₂ layer need to react with ammonia gas at high temperature (more than 800°C) for several hours which hinder its industrial deployment.

In this presentation, the authors will present a promising alternative for the elaboration of titanium nitride thin films using a rapid thermal nitridation process (RTN) (figure 1). This technique consists in the substitution of oxygen of the TiO₂ by the addition of nitrogen under infrared flash of halogen light in a chamber containing ammonia [1-2]. This process is quick and allows to consider the industrial deployment. Nitridated layers have been characterized by X-ray diffraction, Raman spectroscopy, Transmission electronic microscopy (TEM and STEM), Electron Energy Loss spectroscopy (EELS). The optical and electrical properties will be presented as well. A plasmonic application will be presented.

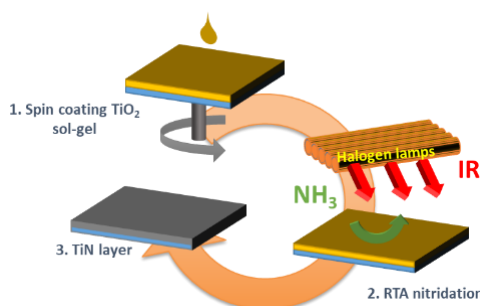


Figure 1. Illustration of a process of nitridation by RTN

References

[1] Valour, A.; Usuga Higueta, M. A.; Crespo-Monteiro, N.; Reynaud, S.; Hochedel, M.; Jamon, D.; Donnet, C.; Jourlin, Y. Micro-Nanostructured TiN Thin Film: Synthesis from a Photo-Patternable TiO₂ Sol-Gel Coating and Rapid Thermal Nitridation J. Phys. Chem. C 2020

[2] Valour, A.; Higueta, M. A.; Guillonau, G.; Crespo-Monteiro, N.; Jamon, D.; Hochedel, M.; Michalon, J.-Y.; Reynaud, S.; Vocanson, F.; Jiménez, C.; Langlet, M.; Donnet, C.; Jourlin, Y. Optical, Electrical and Mechanical Properties of TiN Thin Film Obtained from a TiO₂ Sol-Gel Coating and Rapid Thermal Nitridation Surface and Coatings Technology 2021, 413, 127089.

Oral presentation

Poster presentation