Innovative process of micro-nanostructure of titanium nitride (TiN) by association of a photostructurable titanium oxide (TiO2) and a rapid thermal annealing (RTA)

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

To cite this version:
 Victor Vallejo-Otero, Arnaud Valour, Stéphanie Reynaud, Émilie Gamet, Christophe Donnet, et al.. Innovative process of micro-nanostructure of titanium nitride (TiN) by association of a photostructurable titanium oxide (TiO2) and a rapid thermal annealing (RTA). C’Nano The nanoscience meeting, Mar 2023, Poitiers, France. hal-04094487

HAL Id: hal-04094487
https://hal.science/hal-04094487
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.
Thematic Session: Functional thin Films & Nanostructures: growth & properties
Keywords (max. 4-5): Titanium nitride, Micro-nanostructure, Nitridation, Optical lithography
Disciplinary fields involved: Material Sciences, Optics
Sustainable Development Goals* eventually involved in your research: Responsible Consumption and Production

Innovative process of micro-nanostructure of titanium nitride (TiN) by association of a photostructurable titanium oxide (TiO₂) and a rapid thermal annealing (RTA).

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

1. Hubert Curien Laboratory, Micro-structuration department, University of Lyon, Saint Etienne, FRANCE

The titanium nitride (TiN) is usually used for its thermal, mechanical, electrical and optical properties. Its micro-nanostructure allows to use it in a wide range of applications especially in the area of optic [1] and photocatalysis [2]. These properties combined make this material a promising alternative of gold and silver for optical applications at high temperature or in extreme environment.

The fabrication of microstructured or nanostructured surfaces in TiO₂ and in TiN on large substrates with plane or complex geometry is a challenge. Due to their high thermal, chemical and mechanical stability, TiN layer are difficult to micro-nanostructure by etching or engraving after their deposition. An alternative route is to micro-nanostructure titanium oxide film (TiO₂) before converting it into TiN by a nitridation process [3,4].

In this presentation, a new method of elaboration of micro-nanostructured TiN layer from a TiO₂ photostructurable sol-gel by rapid thermal annealing (RTA) will be presented. This sol-gel is photostructurable by optical lithography and nano-imprint lithography (NIL), allowing an easy and quick production of micro-nanostructure TiO₂ layers (figure 1). These layers can then be converted into micro-nanostructure TiN layers thanks to an RTA of few minutes under ammonia flux. The micro-nanostructured films have been characterized by X-ray diffraction, Scanning Electron Microscopy (SEM), Spectroscopy RAMAN... The optical and electrical properties have been studied and a plasmonic application will be presented.
References (max. 5):

Acknowledgment: The authors acknowledge the French National Research Agency (ANR) for financial support in the framework of project NITRURATION (ANR-21-CE08-0042-01), and the Centre National de la Recherche Scientifique CNRS (French RENATECH+, nano-SaintEtienne plateform).