**COURSE SYLLABUS**

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| **Course Title**：Nano Thin Film Technology | | | | |
| **Credits / Hours** | 3/3 | **Course Number** |  | **□Required ■Elective** |
| **Course Description**  This course deals with the synthesis of nanostructured surfaces and thin films by means of physical vapor deposition techniques such as pulsed laser deposition, magnetron sputtering, HiPIMS, or e-beam evaporation, among others. The nanostructuration of the surface modifies the way a material interacts with the environment, changing its optical, mechanical, electrical, tribological, or chemical properties. This can be applied in the development of photovoltaic cells, tribological coatings, optofluidic sensors, or biotechnology to name a few. This course includes research presenting novel or improved applications of nanostructured thin films, such as photovoltaic solar cells, thin-film transistors, antibacterial coatings or chemical and biological sensors, while also studying the nanostructuration mechanisms, from a fundamental point of view, that produce rods, columns, helixes or hexagonal grids at the nanoscale.  Textbook:  1. Nanostructured Surfaces and Thin Films Synthesis by Physical Vapor Deposition, 2021, Rafael Alvarez, Ed. (MDPI, ISBN：978-3-0365-0394-3)  2. Handout edited by Professors | | | | |
| **Course Topics** | | | | |
| **Topic** | | **Content** | | |
| Introduction | | Introduction to synthesis of nanostructured surfaces and thin films by means of physical vapor deposition | | |
| Nanostructured films by magnetron sputtering | | Recent advances in the development of nanostructured films by magnetron sputtering for energy-related applications | | |
| Nanostructured films by HIPIMS | | Microstructural and electrochemical comparison between TiN coatings deposited through HIPIMS and DCMS techniques | | |
| Nanostructured films by pulsed laser deposition | | A comprehensive overview of what is required to set up this technology and understand the basics of the process | | |
| Nanostructured films by e-beam evaporation | | E-beam evaporation in anti-reflective coatings | | |
| In-situ and real-time nanoscale monitoring of ultra-thin film growth | | To understand the growth of metallic ultra-thin films by continuous dynamic monitoring, using in-situ and real-time optical and electrical probes to analyze the first stages of growth in the MS deposition of a large number of metals with different crystalline structures | | |
| Growth of nanostructured surfaces with plasmonic properties, obtained by the combination of nanosphere lithography and PVD | | Recent advances linking the fabrication routes, the film nanostructure and its plasmonic properties, with special emphasis on its application for the early detection of hepatocellular carcinoma using surface-enhanced Raman scattering and controlling the growth of Ag nanoparticles | | |
| Nanostructured films for thin film transistors | | Improvement of the performance and stability of indium–gallium–zinc–oxide (IGZO) thin-film transistors which are widely used in active-matrix displays | | |
| Nanostructured films for solar cells | | The introduction of Cu2ZnSnSe4 (CZTSe) nano-layer between the metallic (Mo) electrode contact layer and the active absorbing perovskite layer (MAPbI3) to improve the performance of the solar cell | | |