

Master's Thesis – Master in Chemical Engineering

Title: Study of the synthesis parameters on the formation of new nanostructured carbon-based coatings by HiPIMS

Summary: The main objective of this project is the development of new carbon-based nanostructured coatings prepared by high-power impulse magnetron sputtering (HiPIMS) technology that represent a significant advance of conventional coatings. Diamond-like-carbon (DLC) type coatings will be prepared via HiPIMS through modifications in the formation of the plasma, the incorporation of metal ions into the structure (DLC-Me) and the formation of the nanocomposite nc-MeC/a-C:H, using an industrial magnetron sputtering reactor. The preparation of the coatings will be carried out in Flubetech S.L. and the thin film characterization will be carried out at IQS. The mechanical (scratch test, nanohardness) and tribological (friction, wear) properties will be evaluated and correlated with the structure.

The development of a new DLC coating for cutting tools used in the machining of aluminum would have a significantly impact. Specifically, the electric vehicle and airplane manufacturing industries stand to benefit greatly from this innovation, because of the need to use lightweight materials to reduce fuel consumption and CO₂ emissions and increase the range of electric vehicles and planes. The results are expected to have a significant impact in the scientific community by stablishing new standards in the DLC recipes that includes HIPIMS [1,2].

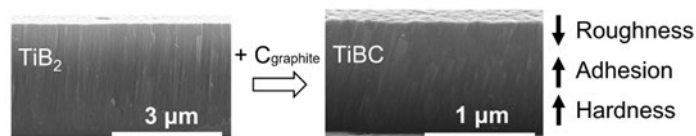
This project will combine the expertise in coating preparation in an industry such as Flubetech S.L. (Dr. C. Colominas) with the experience in nanocharacterization of IQS (Dr. M.D. Abad).

The following papers were similar Master's Thesis projects at IQS.

1. *Nb-C thin films prepared by DC-MS and HiPIMS: synthesis, structure and tribomechanical properties.* Surface & Coatings Technology 2021, 422, 127569. <https://doi.org/10.1016/j.surfcoat.2021.127569>

2. *Influence of the carbon incorporation on the mechanical properties of TiB₂ thin films prepared by HiPIMS.* International Journal of Refractory Metals and Hard Materials. 2022, 107, 105884. <https://doi.org/10.1016/j.ijrmhm.2022.105884>

Carbon incorporation into TiB₂ HiPIMS thin films



Supervision: Dr. M.D. Abad & Dr. C. Colominas

Laboratories: Flubetech S.L. & Nanotechnology and Advance Materials Lab (IQS)

Starting date: Preferably September 2023

Applications are welcome: write a mail to M.D. Abad (manuel.abad@iqs.url.edu)