

Thesis Proposal for the Master's Degree in Physics

Gruppo "Superfici e Energia"

Ref. Prof. Raffaele G. Agostino

The Surface and Energy research group at the University of Calabria, led by Raffaele G. Agostino, focuses on studying materials with innovative chemical-physical properties for both fundamental and applied purposes, such as energy and electronics. The team, consisting of researchers and collaborators, utilizes **advanced spectroscopic and microscopic techniques** (HREELS, XPS, UPS, SEM, etc.) to characterize surfaces and interfaces. Currently, they are involved in building the **STAR X-ray source** for advanced microtomography and spectroscopy studies. Their main research areas include gas adsorption in nanostructured materials, the characterization of self-assembled molecular layers, the analysis of two-dimensional systems like graphene, and the development of advanced tomographic imaging techniques. Additionally, the group contributes to the **DeltaH laboratory** for hydrogen storage solutions and conducts pioneering research in **virtual histology** using **artificial intelligence** techniques for tissue analysis.

Title:

Optimization of Carbon-Based Materials for Enhanced Hydrogen Adsorption

Abstract:

This thesis investigates the optimization of the activation process during the pyrolysis process to produce activated carbons from amorphous cellulose. Activated carbons are characterized by high porosity, structural stability, and recyclability, making them promising candidates for hydrogen storage applications. The study focuses on understanding the effect of activation time on specific surface area, pore volume, and micropore fraction (<2 nm) and how these structural parameters influence hydrogen adsorption. Morphological properties were analyzed with scanning electron microscopy, while textural and adsorption characteristics were measured using a volumetric apparatus at cryogenic temperatures and pressures up to 80 bar, providing insights into the viability of these materials for sustainable energy applications.

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Laboratory where the thesis is carried out:

Surface and Energy Lab

Type of thesis:

Experimental and data analysis