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:
X-ray Computed Microtomography for Non-Destructive Characterization of Specialty Optical Fibers

Abstract: The limited suitability of silica fibers for mid-infrared applications, due to high phonon loss, has driven the development of new specialty optical fibers made from novel materials. These fibers present unique challenges in characterization, as traditional methods often fall short in assessing their complex geometrical and optical properties. This thesis explores the use of absorption contrast X-ray computed microtomography as a non-destructive technique for fiber characterization. Experimental results demonstrate that the tomographic intensity profile within the fiber core mirrors the refractive index distribution, which is verified through complementary energy-dispersed X-ray spectroscopy. Step- and graded-index soft glass fibers, including both commercial and in-house samples, were evaluated, highlighting the technique's effectiveness in assessing soft glass compositions over silica, owing to enhanced X-ray absorption. This study provides valuable insights into the potential of X-ray microtomography as a reliable, real-time monitoring tool in the production and optimization of specialty optical fibers.

Supervisor(s):
Vincenzo Formoso, Mario Ferraro

E-mail(s):
vincenzo.formoso@unical.it
mario.ferraro92@unical.it

Laboratory where the thesis is carried out:
μTomo/SoftX-STAR in collaboration with Department of Information Engineering, Electronics and Telecommunications, Sapienza University of Rome

Type of thesis:
Experimental and data analysis