A Novel Route to Nickelate Superconductors through the Synthesis of $La_3Ni_2O_7$ Nanofibers via Solution Blow Spinning

M.P Brambilla[1], A. P. Arrieta[1], M. Motta[2], R. Zadorosny[1]

[1] São Paulo State University (Unesp), School of Engineering, Campus Ilha Solteira - Physics and Chemistry Department.

[2] Federal University of São Carlos (UFSCar) Center for Exact Sciences and Technology (CCET).

e-mail: matheus.p.brambilla@unesp.br

Keywords: superconductor, nickelates, nanofibers, La-327, Advanced Materials.

The quest for high-critical-temperature superconductors has identified nickelates as a promising frontier due to their structural and electronic similarities with cuprates [1]. Among them, $La_3Ni_2O_7$, which exhibits superconductivity at 80 K under pressure, stands out as a key candidate for exploring superconducting mechanisms in nickel-based systems. However, a major challenge for their application lies in achieving samples with a high superconducting volume fraction [2]. This study tackles this limitation through a distinctive two-fold strategy: (i) the development of a novel one-pot synthesis protocol and (ii) the implementation of an innovative fiber-formation technique. The synthesis begins with the dissolution of nickel and lanthanum acetates in a mixture of propionic acid, ammonium hydroxide, and methanol, stabilized and reduced using polyvinylpyrrolidone (PVP), to produce a highly homogeneous precursor solution with precise stoichiometric control. This solution is subsequently processed into polymeric mats composed of nanofibers using the Solution Blow Spinning (SBS) technique. The central hypothesis is that the high surface-area-to-volume ratio of the fibers promotes enhanced reaction kinetics, leading to improved phase formation and, consequently, a higher superconducting volume fraction in the final material.

Acknowledgements: We thank the FAPESP grant 2024/21097-7, CAPES - Finance Code 001.

References:

[1] Sun, Hualei, et al. Nature 621, 7979 (2023)

[2] ZHOU, Yazhou et al. Matter Radiat. Extremes 10, 027801 (2025)

This abstract will be used for both events: the oral presentation at the 1st International Scientific Conference and the poster session at the III Russian-Chinese International School 2025.