Material aspects of superconducting candidate $La_3Ni_2O_7$

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Recent reports have suggested high-temperature superconductivity in pressurized $La_3Ni_2O_7$ (La-327), triggering intense interest in this bilayer nickelate system. However, establishing whether superconductivity is truly bulk and identifying its microscopic origin remains challenging. Accumulating evidence points to a complex materials landscape in La-327, including narrow phase stability, layer intergrowth, oxygen non-stoichiometry, oxygen site occupancy, structural distortion, and strain. We discuss how these intertwined structural and chemical factors complicate the interpretation of superconducting signatures. We present our thermogravimetry (TG) and nuclear quadrupole resonance (NQR) studies of powder La-327, focusing on how oxygen stoichiometry and local electronic environment vary depending on synthesis method, *A*-site substitution and partial oxygen pressure and temperature (pO_2, T) post-annealing history. We correlate the local electronic environment with the superconducting volume fraction under high pressure. This approach provides a materials framework for assessing structural and chemical factors relevant to superconductivity in La-327.

References

[1] A. Krajewska *et al.*, in preparation.