Poster-1-5

Ground State of the Superconductor Parent Compound Rare Earth Nickelates Bulk Single Crystals

Dariusz Jakub Gawryluk,[1] Yannick Maximilian Klein,[1] Shangxiong Huangfu,[2] Ivan Ardizzone,[3] Jérémie Teyssier,[3] Hai Lin,[2] Mirosław Kozłowski,[4] Dirk van der Marel,[3] Andreas Schilling,[2] Anthony Linden,[5] Marisa Medarde,[1] and Ekaterina Pomjakushina[1]

[1] *Laboratory for Multiscale Materials Experiments, Paul Scherrer Institut, 5232 Villigen PSI, Switzerland*
[2] *Department of Physics, University of Zürich, Winterthurerstrasse 190, CH-8057 Zürich, Switzerland*
[3] *Department of Quantum Matter Physics, University of Geneva, 24 Quai Ernest-Ansermet, 1211 Geneva 4, Switzerland*
[4] *Łukasiewicz Research Network Tele and Radio Research Institute, 11 Ratusznowa Street, 03-450 Warsaw, Poland*
[5] *Department of Chemistry, University of Zürich, Winterthurerstrasse 190, 8057 Zürich, Switzerland*

$3D$ bulk perovskite-like nickelates, $RO(R\text{NiO}_{3\pm\delta})_n$, ($\delta = 0$; $n = \infty$) are widely known for their spontaneous, temperature-driven Metal-to-Insulator Transition (MIT). The MIT, which occurs in the system, is associated with a specific charge redistribution and subtle structure lowering from $Pbnm$ to $P2_1/n$ space group. Furthermore, the insulating state orders magnetically below Neel temperature (T_N) [1], what is expected to be accompanied by inversion symmetry breaking [2,3]. Simultaneous chemical tailoring and dimensionality adjustment of some family members ($\delta \leq 0$; $n = 5$ or ∞) induce superconductivity with critical temperature (T_c) up to ≈15 K [4,5]. That can be realized in thin films by substitution of alkali earth metal in R-site or varying R : Ni ratio, both simultaneously followed by topochemical oxygen uptake. Recent results of ground state tuning between MIT [6], multiferroicity [7], and spin-glass [8,9] in bulk single crystals [6,10] of rare earth nickelates superconductor parent compounds will be presented.

[1] D. J. Gawryluk, et al., Phys. Rev. B 100, 205137 (2019).
[2] G. Giovannetti, et al., Phys. Rev. Lett. 103, 156401 (2009).
[3] J. M. Perez-Mato, et al., J. Phys.: Condens. Matter 28 286001 (2016).
[4] D. Li, et al., Nature 572, 624 (2019).
[5] G.A. Pan, et al., Nat. Mater. 21, 160 (2022).
[6] Shangxiong Huangfu, et al., Phys. Rev. B 101, 104104 (2020).
[7] I. Ardizzone, et al., Phys. Rev. Research 3, 033007 (2021).
[8] Shangxiong Huangfu, et al., Phys. Rev. B 102, 054423 (2020).
[9] Hai Lin , et al., New J. Phys. 24, 013022 (2022).
[10] Y. M. Klein, et al., Cryst. Growth Des. 21, 4230 (2021).