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Topotactic hydrogen in LaNiO₃-xHy thin films studied by neutron reflectometry

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The modification of epitaxial layers through hydrogenation is a thriving field of research that offers diverse opportunities to tune the physical properties of different systems. Recent research has been extended to correlated oxide interfaces, where hydrogen induced, reversible metal-to-insulator transitions have been uncovered in material systems such as rare-earth nickelates [1-2]. Neutron scattering methods are without doubt one of the best way to study these systems. In this talk we will show the results of the first neutron reflectometry (NR) study of in situ hydrogen exposure of LaNiO₃ to hydrogen gas. In particular the combined use of deuterium and hydrogen allowed us to distinguish and quantify oxygen depletion and hydrogen incorporation, which are two possible mechanisms to explain the electronic modification of the host layer. In addition to the neutron measurements, we will show other complementary techniques used to understand the incorporation phenomena, including electrical transport and x-ray methods.

References

[1] J. Shi, Y. Zhou, S. Ramanathan, Nat. Commun. 2014, 5, 4860.

[2] Haowen Chen, et al. Nano Letters 2022 22 (22), 8983-8990

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