Contribution ID: **64** Type: **Talk (20 min + 5 min discussion)**

Understanding the mechanisms of hydrogen induced modifications in correlated oxides.

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Correlated oxides are the ideal platform for hydrogen induced structural and electronic modifications, due to the presence of high amount of oxygen, a quite flexible crystal structure and the delicate balance between structural and electronic degrees of freedom. A striking example are the nickelates, for which hydrogen can induce metal to insulator transitions [1], superconductivity [2], and colossal lattice expansion [3]. The mechanisms of interaction between hydrogen and the oxide is often not fully understood, due to the difficult detection of hydrogen in thin films. Neutron reflectometry (NR), in combination with x-ray scattering and other complementary techniques, can be a powerful tool for non-destructive, in situ, non-local characterization of such systems. Here we report on the specific case of $LaNiO_3$ which exhibits an intermediate insulating state followed by re-entrant metallicity accompanied by colossal expansion during hydrogen exposure. Via in situ NR we measured time-dependent hydrogen and oxygen content in the layer during reaction with H_2. By combining the stoichiometry obtained from NR with the x-ray diffraction and absorption spectra at various stages of reaction we propose a full reaction mechanism to explain the electronic phase changes observed.

References
[1] J. Shi, Y. Zhou, S. Ramanathan, Nat. Commun. 2014, 5, 4860.
[2] Ding, X., Tam, C.C., Sui, X. et al. Nature 615, 50–55 (2023).
[3] Haowen Chen, et al. Nano Letters 2022 22 (22), 8983-8990

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