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B-site substitution in $LaTiO_3$ thin films: influence on the titanium oxidation state. A. GUILLER, C. MARCHIORI, M. SOUSA, R. GERMANN, J. P. LOCQUET, J. FOMPEYRINE, IBM Research GmbH, J. W. SEO, IPMC, Ecole Polytechnique Federale de Lausanne — $LaTiO_3$ (LTO) is a Mott insulator, antiferromagnetic at RT, and exhibits a Metal Insulator Transition (MIT) at the Neel temperature. Despite its complex chemistry, it is an interesting candidate to fabricate field-effect devices. A full device requires the deposition of a dielectric in contact with the LTO thin film such as HfO_2. This choice will be discussed, and we will present issues related to a possible interdiffusion. Adding Hf in the LTO layer leads to a clear change of the resistivity measured as a function of temperature, and strongly influences the MIT temperature. Starting from a semiconducting LTO, 20% Hf substitution on the perovskite B-site makes the layer become metallic from RT down to 4.2K. The average valence of Ti is increasing from Ti^{3+} towards Ti^{4+} with the substitution of Hf, as shown by XPS. Several explanations can be proposed beyond a real incorporation of Hf into the LTO matrix. Besides a pure electronic effect, structural and catalytic effects have been then investigated in details by means of XRD, XPS and HRTEM. Multilayers as well as single-phase thin films have been fabricated to disentangle these different effects. Our results will be discussed taking also into account a possible material loss in the structure. We will in particular explore the behavior of La-deficient structure to qualitatively explain our data.

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