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ELECTRONIC STRUCTURE AND HYDRO-OXIDATION OF $LaNiO_{3-\delta}$ THIN FILMS

S. Mickevičius [1*], S. Grebinskij [1], V. Bondarenka [1], H. Tvardauskas [1], M. Senulis [1], V. Lisauskas [1], K. Sliužienė [1], and B.A. Orlowski [2]

[1] *Semiconductor Physics Institute, A. Goštauto 11, 00-00 Vilnius, Lithuania*

[2] *Institute of Physics, PAS, Al. Lotnikow 32/46, 02-668 Warsaw, Poland*

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**) e-mail: orbro@ifpan.edu.pl*

$LaNiO_3$ is one of the few conductive oxides with a crystal structure suitable for integration in epitaxial heterostructures with perovskites of enormous technological potential such as colossal magnetoresistance materials, high-temperature superconductors and ferroelectrics.

It is known that electronic structure of $LaNiO_{3-\delta}$ strongly depends on the degree of stoichiometry δ and metal-dielectric transition take place at $\delta \approx 0.25$ [1]. Moreover, the considerable segregation of elements takes place in chemically synthesized $LaNiO_{3-z}$ samples i.e. the surface concentrations of various species differ from the volume one. Another factor to be considered is the tendency of rare earth and nickel oxides to absorb water vapor.

In the previous paper [2] it was shown that the interaction with ambient water lead to the formation of lanthanum and nickel hydroxide containing phase at $LaNiO_{3-\delta}$ surface. The thickness of hydroxide enriched ~ 2 nm layer was estimated by means of Tunable High-Energy X-ray photoelectron spectroscopy using synchrotron radiation

In this paper, in addition to resistivity measurements, we utilize the surface sensitivity of XPS to study the influence of preparation conditions and heat treatment in various atmospheres on the properties of $LaNiO_{3-\delta}$ film.

It was found that after annealing in vacuum at 700°C the relative concentration of hydroxide species increases and electrical conductivity becomes dielectric in nature.

The $LaNiO_{3-\delta}$ films remain metallic after high-temperature (750°C) annealing in an oxygen atmosphere, while concentration of the hydroxide species slightly decreases.

Unfortunately, the ESCA sensitivity is insufficient to determine surfaced chemical composition with an accuracy enough to distinguish are the oxygen vacancies or La/Ni hydroxide species responsible for metal-dielectric transition after high-temperature annealing in vacuum.

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References

[1] M. Abbate, G. Zampieri, F. Prado, A. Caneiro, J.M. Gonzalez-Calbet, M. Vallet-Regi, "Electronic structure and metal-insulator transition in $LaNiO_{3-\delta}$", *Phys. Rev. B* **65** (2002) 155101-155106.

[2] S. Mickevicius*;* S. Grebinskij, V. Bondarenka, V. Lisauskas, K. Sliuziene, H. Tvardauskas, B. Vengalis, B.A. Orlowski, V. Osinniy, W. Drube, "The surface hydro-oxidation of $LaNiO_{3-x}$ thin films", *Acta Phys. Polon. A* **112** (2007) 113-120

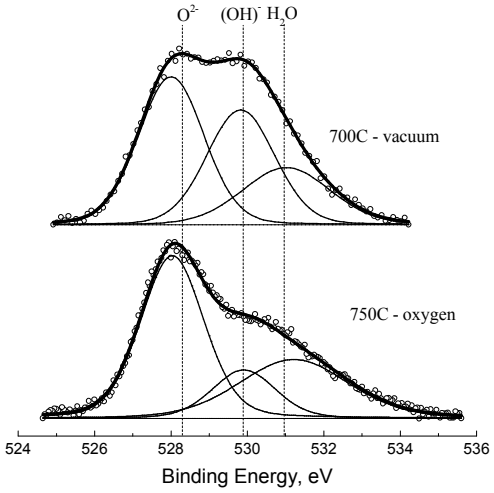

Figure 1. O 1s XPS spectra of $LaNiO_{3-\delta}$ films annealed in vacuum and in oxygen.