CVT SINTERING OF CONDUCTIVE $Fe_2O_3{\cdot}(ZnO)_k$ ALLOYS

G. V. Colibaba[1,*], D. Rusnac[1], V. Fedorov[1], V. Suman[2], D. Topal[1],
E. V. Monaico[2], N. Spalatu[3], A. Sidorenko[2], O. Shikimaka[1]
[1]*Institute of Applied Physics, Moldova State University, Chișinău, Republic of Moldova;*
[2]*Technical University of Moldova, Chișinău, Republic of Moldova;*
[3]*Tallinn University of Technology, Tallinn, Estonia*
[*]E-mail: gkolibaba@yandex.ru

Thin films of $Fe_2O_3{\cdot}(ZnO)_k$ alloys have diverse application prospects. Depending on the composition (k), these alloys can have different chemical, electrical and optical properties. For example, the alloy with k = 1 ($ZnFe_2O_4$) has wide applicability for use as chemical sensors [1]. Magnetron sputtering of ceramic targets is a relatively simple and cost-effective method for producing thin films, but this technology requires ceramic targets with high uniformity and density. Recently, a new ceramic sintering method based on chemical vapor transport (CVT) has been developed for ZnO [2, 3]. CVT ZnO ceramic targets are easily doped and can be operated at high magnetron power, promoting to high structural perfection and conductivity of thin films [4, 5].

The sintering of $Fe_2O_3{\cdot}(ZnO)_k$ alloys (k = 0.5 – 7) by the CVT method using a HCl + H_2 gas mixture as a transport agent has been developed. Fe_2O_3 + kZnO mixed micropowders were axially compressed (25 MPa) and loaded onto the flat bottom of chambers. Before loading the transport agent, the sintering chamber and the material were purified by annealing in a dynamic vacuum. CVT ceramics were sintered in sealed quartz chambers at 1050 °C for 24 h. For comparative analyses, classical ceramic samples were also sintered in air under the same conditions.

The advantages of the proposed sintering method are the following: (i) low sintering temperature and cost-effective equipment; (ii) the use of simple and cost-effective micropowders as a source of material; (iii) higher density (relative density 91 %) and higher hardness (1.66 GPa) of the obtained ceramics, higher crystallite size (60 mkm) and structural perfection; (iv) high electron conductivity variable in a wide range due to Cl impurity and controllable stoichiometric deviation; (v) CVT ceramics, which have high electrical and thermal conductivity, can be used as targets for high-power magnetron sputtering, increasing the structural perfection of deposited thin films with different chemical composition, electrical and optical properties.

ACKNOWLEDGEMENTS: This work was supported by the Ministry of Education, Culture and Research of Moldova under the projects No. 011201 and 020201 in collaboration with Estonian Research Council projects PSG689 and COST Action project CA21148 (RENEW-PV)

[1] A.C. Ulpe et al. *De Gruyter, Z. Phys. Chem.* (2019)
[2] G.V. Colibaba et al. *Journal of the European Ceramic Society* **41** (2021) 443
[3] G.V. Colibaba, D. Rusnac, N. Costriucova, O. Shikimaka, E.V. Monaico. *J Mater Sci: Mater Electron* **34** (2023) 82
[4] G.V. Colibaba, D. Rusnac, V. Fedorov, E.I. Monaico. *J Mater Sci: Mater Electron* **32** (2021) 18291
[5] G.V. Colibaba. *Solid State Sciences* **97** (2019) 105944