P4. Diameter modulated GaAs nanowire arrays via crossing crystallographic pores

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The morphologies and properties of the produced porous semiconductor materials are determined by the mechanisms of the pore growth during electrochemical etching of the bulk semiconductor wafers [1]. Depending on the mechanism of growth, pores with different characteristics are formed in terms of their shape, velocity of growth, etc. On the other hand, the pore growing mechanism depends on the characteristics of the initial bulk semiconductor material and the specific anodizing conditions [2,3].

Only crystallographically oriented pores were reported up to now in GaAs crystals subjected to anodization. The main feature of the crystallographically oriented pores, in contrast to current line oriented pores, consists in their ability to intersect each-other and grow at low applied potentials or current densities. The formation of GaAs nanowire arrays aligned perpendicular to the substrate surface was reported for (111)B oriented GaAs substrates in 1M HNO_3 electrolyte via one step anodization [2].

It will be reported that at optimized electrochemical parameters, the growth of perpendicular nanowires to the surface occurs with simultaneous growth of tilted pores intersecting them. As a result, diameter modulated nanowires are obtained due to the penetration of tilted pores through nanowires. The proposed approach is feasible for obtaining GaAs diameter modulated nanowires along the length as long as 200 μm. The tree-dimensional modulation of diameter, including the functionalization with magnetic materials, will give the possibility to increase the area of their applications.

References:

[1] Monaico, E.; Tiginyanu, I.; Ursaki, V. Porous Semiconductor Compounds. *Semicond. Sci. Technol.* **2020**, *35*, 103001, doi:10.1088/1361-6641/ab9477.

[2] Monaico, E.I.; Monaico, E.V.; Ursaki, V.V.; Honnali, S.; Postolache, V.; Leistner, K.; Nielsch, K.; Tiginyanu, I.M. Electrochemical Nanostructuring of (111) Oriented GaAs Crystals: From Porous Structures to Nanowires. *Beilstein J. Nanotechnol.* **2020**, *11*, pp. 966–975, doi:10.3762/bjnano.11.81.

[3] Monaico, E.I.; Monaico, E.V.; Ursaki, V.V.; Tiginyanu, I.M. Evolution of Pore Growth in GaAs in Transitory Anodization Regime from One Applied Voltage to Another. *Surf. Engin. Appl.Electrochem.* **2021**, *57*, pp. 165–172, doi:10.3103/S106837552102006X.