

Nanocomposites and nanomaterials

Preparation of BaTiO₃ multilayer films by inkjet printing

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It is known that the specific capacitance of a ceramic capacitor can be increased by thinning the dielectric layers and increasing of their number. This can be effectively performed only with using new depositing techniques, such as inkjet printing [1, 2]. In this work we describe possibility of inkjet printing of the multilayer dielectric films using ceramic inks based on BaTiO₃ nanopowder.

Ink preparation method had been described in [2]. Barium titanate nanopowder with a mean particle size of 20 nm had been used as a green material. Solid phase concentration in the ink volume had been estimated 5 wt. %.

Prepared ink had been printed into the flexible polymer substrate using thermal inkjet printer.

Table 1. Properties of the printed multilayer films

Deposited layers	Total thickness, nm	Ra, nm	Rz, nm
substrate	0	14,3	74,3
one	600	39,8	119,9
two	270	20,3	70,6
three	260	24,3	78,01

Optical profilometry of the investigated films (table 1) had shown essential thinning of the deposited structure with sequential printing of each subsequent layer. Thus, thickness of the single-layer non-sintered film had been estimated of about 600 nm.

Total thickness of the double-layer structure had decreased to 270 nm and after printing the third layer this parameter had been amounted to 260 nm. Also roughness parameters decreasing had been observed for the deposited dielectric films after each subsequent reprinting. In particular, arithmetical mean deviation of the roughness profile (Ra) for the single-layer coating had amounted to 39.8 nm and maximum height of the roughness profile (Rz) had equal to 119.9 nm. Simultaneously, these values for the three-layer structure had been equal to 20,3 and 70,6 nm respectively.

1. Kyrpal R., Dulina I., Umerova S., Nikulin A., Ragulya A. Inkjet printing of thin dielectric films based on BaTiO₃ // Proc. NAP.-2013.-2, N1.-P NTF35-1-3
2. Kyrpal R., Ragulya A. Structural and rheological characterization of ceramic inks based on BaTiO₃ nanopowder // Nanostr. Mater.-2013.-10, N 2.- P 40-50.