Advanced Capacitive Converters Based on Al/ITO/Polyimide/Al_2O_3 Heterostructures

Zaitseva L.V.[1,2], Khrypunov G.S.[1], Zaitsev R.V.[1], Momotenko O.V.[1]

[1]*National Technical University "Kharkiv Polytechnical Institute", Kharkiv, Ukraine*
[2]*OJSC «Turboatom», Kharkiv, Ukraine*

The necessity of simplification the control technology of metal products in industrial production led to further development of widely implemented acoustic methods. Significant experience of practical utilization of piezoelectric method has identified areas where it is not effective: for control of products with contaminated surface, affected by corrosion or coated. Thus, devices that will perform liquidless acoustic control need to be created for practical defectoscopy purposes. The promising ones can be based on the capacitive method for generating and receiving of acoustic signals, which has fundamentally different physical mechanism for generating of an acoustic signal in control object, its surface is one of the capacitive plates and generates a signal without liquid for acoustic contact. However, existing capacitive compositions do not allow obtaining of the required sensitivity.

It appears to be quite actual to use a polyamide film with thickness of 15 to 125 microns as a dielectric layer and a basis for capacitive converters, that is 10 times less than the thickness of the classic dielectric layers, on which can be fabricated the capacitive converters by coating of the surface with thin film layers of ITO layer (0,2-0,3 μm) as a converter conductive plate and Al_2O_3 dielectric layer (1 μm) for increase the dielectric constant value. In general, the capacitive converter can be based on ITO/polyimide/Al_2O_3 heterostructures.

Past studies of the film layers crystal structure, their electrical properties and surface morphology allowed to determine the optimum technological conditions of manufacturing such capacitive converters. They also allowed creating a prototype of a thin film capacitive converter based on Al/ITO/ polyimide/Al_2O_3 heterostructure for acoustic control of metallic products with ten times higher sensitivity comparatively with classic capacitive converters.

1. Zaitseva L.V. Flexible film capacitive converters based on the ITO/ polyimide/Al_2O_3 structure / L.V. Zaitseva, G.S. Khrypunov, R.V. Zaitsev, A.L. Khrypunova // Physical surface engineering – 2014. –№4. – P. 505–509.