

1.2.4. QUALITY CONTROL OF COMPLEX STRUCTURE DIELECTRIC MATERIALS BY NON-DESTRUCTIVE TESTING ELECTRODISCHARGE FREQUENT METHOD

Kozharinov Val.Vi., TUV Nord Baltik, Riga, Latvia;
Kozharinov Vi.Val., Moscow State University, Moscow, Russia

Dielectric materials as substrates, thin layers and films find wide application in microelectronics. Practically any electronic instrument and integrated chip cannot be created without dielectric. For want of it the major significance has excellence quality of dielectric as material, and it's surface. Therefore a control of dielectric parameters is certainly necessary in the beginning of technological process, and at ready chips. Naturally, the non-destructive methods are more preferable. Among last rather universal and perspective method is electrodischarge frequency method (EDF) of a non-destructive testing [1]. The method is based on parameters registration of the impulse gas discharge originating in an air interval between a needle and plane electrode with dielectric between them depending on physical-geometrical parameters of a discharge interval and the electrical field values, defined by the power, enclosed in them. The impulse character of a discharge current is stipulated by the periodic discontinuance of electronic stream in the microdischarge channel called in main accumulation of a adsorption charge on a covered dielectric surface of an electrode – object. The availability of the latter results in existence of limitation on the maximum allowable value of a charge, carried in the channel of the single microdischarge. In a common case this value is determined by dielectrical properties of cover and characteristics of a chain of power supply. The frequency of discharge current pulsings is determined by change dynamics of a surface charge, which depend on the properties of a surface and gas influential in movement of a charge on a surface (the surface discharge, a charge spreading at the expense of surface and volumetric conductivity). The linear character of frequency dependence of discharge current pulsings from its average value allows to process for want of analysis of influence physical – geometrical parameters of dielectric cover to the characteristics of the gas discharge from measurement of small currents (nA) to frequency measurements (range 1 Hz – 10 KHz), that essentially simplifies process of measurements and increases their reliability for want of preservation of high sensitivity of a method. The space resolution of a method is stipulated by the value of a microdischarge channel diameter and does not exceed 0.1 mm for want of to value of a discharge interval less than 1 mm for geometry of electrodes – the edge – plane electrode covered dielectric and, accordingly, interaction effective square with dielectric cover, which physical properties render influence on processes of charge carry of a in a discharge zone (no more than 0.01 mm²), and set up 0.1 mm [2]. The method is nondestructive, as the working power always is lower than power spark puncture, and dielectric destruction does not occur. The method is suitable for diagnostics thickly and thin-film dielectric covers on the conduction basis, including with evaporation conduction films, that especially is necessary for microelectronic components [3].

Today this method allows to expand own possibilities thanks to application of modern technologies such as application for test results estimation of of adaptive systems of the automated data processing in the conditions of the incomplete and indistinct information in which basis artificial neural networks are. Besides, the given method easily enough allows to use modern computer technologies, which thanks to the newest systems of recognition of images that will give the chance to raise appreciably reliability and the information of thin dielectric films test by EDF method.

References:

1. **Kozharinov V.V., Mashkancev A.G., Kasperik S.S.** “A Method of a control of electrodurability of dielectric covers on a metal substrate”. Inventors Certificate 1457580 (USSR). Bull. of Inventions N 13, (1988), (in Russian).
2. **Kozharinov V.V., Sushentsov V.N., Mardilovich P.P.** Defektoscopya, 2, (1996), (in Russian).
3. **Kozharinov V.V., Mukhurov N.I., Sushentsov V.N., Mardilovich P.P.** “Quality control of complex structure dielectric materials by non-destructive testing electrodischarge frequent method with allowance of features of anodic alumina”, 15th World Conference on Non-Destructive Testing, Roma – 15–21 October, 2000.