

Diagnosing of Technical State of the Products of Electronics by Acoustic Emission method

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Abstract – The paper presents some results of practical application of the methods and devices for acoustic emission diagnostics of the technical state of the Products of Electronics.

Keywords - Acoustic emission, Diagnosing strength, Localizing failure.

I. INTRODUCTION

The paper introduces the developed methods and means of computer AE control and diagnosing the technical state of electronics details and the instances of their practical use.

II. STRENGTH DIAGNOSING OF CAPACITORS AND MICROASSEMBLY FRAMES

Capacitors of K 15-5 type are ceramic disk, polymerized by a compound. Because of the difference in the coefficients of linear expansion of ceramic and compound during the change of temperature in the ceramic-compound joint temperature strains appear, which may lead to cracking of the ceramic and compound and destruction of joint construction, influenced by especially negative combinations of both materials.

The destruction of ceramic in the K 15-5 construction during temperature cycling was found to originate from its train in the direction of lengthwise disk axes and on the platforms, tilted to the butts of disks at the angle of 45°, because of compression in radial directions from the action compound.

The separation of AE signals, emitted by the compound and ceramic parts of K 15-5 capacitor construction, on the basis of frequency has been carried out. The operative frequency band for AE signals is as follows: for ceramics K-15 - 650-1000 kHz; for compound EK-242 – 130-300 kHz.

Based on the analysis of the results of capacitor testing carried out by means of temperature cycling in the vacuum chamber under the temperatures of +60°C - -50°C using a waveguide, P 113 sensor (0,2 – 2,0) and six-channeled acoustic emission station [1] the method of nondestructive diagnosing and control of strength and prevention of dangerous states in permanent connections of different composites taking as the example the construction of compounded ceramic K 15-5 capacitors, working under conditions of temperature cycling from +60°C to 50°C.

Microassembly frames of microwave frequency, manufactured from aluminum alloy AMg-2, is a permanent connection of base and cover, made with the help of laser welding. These quite critical units are used in modern Ukrainian planes. In the process of operation, i.e. while ascending to a high altitude, internal overpressure emerges in

the frames, which may cause the destruction of joint weld and depressurization of the frames. AE method enabled increasing reliability of manufactured frames, making it possible to diagnose, control and prognosticate the strength and hermiticity of frames in manufacturing and operation.

Consequently, there has been developed the method of nondestructive control, predicting strength and hermiticity of microassembly frames of microwave frequency.

There has been worked out the method of nondestructive control of strength and prevention of dangerous states in microassembly frames of microwave frequency, operating in the conditions of internal pressure difference in the pulsating cycle. The developed method is intended to exercise nondestructive control strength and hermiticity of frames, operating aboard. The control of frames is done automatically during the flights by means of acoustic emission measuring device, installed on the board of plane. AE sensor, transmitting AE signals to the measuring device, is set in the controlled frame with display panel, informing about the emission of AE signals, in pilot's cabin. If for some reason the AE device cannot be installed aboard, the frame control is run by the technician who services the equipment in the plane and tests the frames by internal overpressure every 5 flights and landings.

III. CONCLUSION

- (1) we have proposed the method of nondestructive diagnosing and strength control and prevention of dangerous states of permanent connections of different composites showing as an example the structures of compounded ceramic capacitors K 15-5, working in the conditions of temperature cycling from +60°C to -50°C;
- (2) the method of nondestructive diagnosing and predicting strength and hermiticity of microwave frequency microassembly frames under safe testing by means of internal overpressure in static state.
- (3) the method of nondestructive strength control and prevention of dangerous states of microwave frequency microassembly frames, installed on the board of aircrafts, when as a result of flights and landings frames experience the pressure difference in pulsating cycle and a danger of joint weld failure and depressurization of frame occurs.

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