1.10.26. PROPERTIES DIAGNOSTICS OF STRUCTURES MADE OF POLYMER AND COMPOSITE MATERIALS

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Modern trends in aircraft industry define new directions in the filed of development of new materials and their diagnostics at different stages of their PLC. These trends are governed mostly by increased requirements to aircraft in development, i.e.

- High operational temperatures;
- Low weigh of an aircraft unit;
- High resource durability;
- Decrease of fitting work labor content;
- Testability assurance;
- Conditional operation possibility.

In connection with these requirements, the polymer composite materials (PCM) based on carbon fibers are of the most interest.

At present, designing technologies and production of parts made from PCM made a great progress (computer systems of a layer-by-layer parts designing, automated let-up, different modes of moulding with application of high tech equipment), whilst the same technologies of non-destructive testing and diagnostics are used as well as on metal parts. In general these are different types of acoustic testing non-destructive testing.

Capabilities of the traditional acoustic testing (with piezoelectric excitement of acoustic oscillations) are severely limited by peculiarities of parts made from carbon PCM and physical peculiarities of the method itself:

- Acoustic oscillations High degree of decay in materials;
- Fiber bundles aptitude;
- Instability of the moulding process, hence equipment adjustment difficulties for uniformity of products;
- Testing results interpretation difficulties;
- Low testing informativeness;
- Existence of a blind spot.

New technologies of acoustic oscillations excitement in a material under testing and computerized processing of received signals offer new opportunities for acoustic testing that can be divided into two groups:

1. Materials properties diagnostics.

High sensitivity and resolution enables to determine dependence of acoustic wave velocity changes in material from such characteristics as density, voids rating, solidity characteristics.

2. Non-destructive testing of materials.

High sensitive flaw detection, with no blind spot and increased informativeness and productivity of testing.

At present, industrial implementation of the described equipment and technologies is being carried out and development of normative document is in the process in the meantime.

In comparison with nowadays “trendy” technology of utilization of phased arrays in production of acoustic flaw detectors (which is, basically, only an instrument for increase of productivity and informativeness of NDT), laser-acoustic diagnosis and flaw detection has grate opportunities for its implementation in many production and medical industries.