

Influence of radiation on Composites and Nondestructive Testing Plastic

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Modern submarines tend to be overloaded power equipment, equipment and weapons. Creating a ship's vibration-damping mounts and vibration isolators for machinery of the submarine in addition to their primary purpose - to secure the requisite vibroacoustic characteristics - requires a significant minimization of the weight and dimensions, while maintaining their strength characteristics. In line with this perspective for use on submarines are composites of polymer-based.

As the ship's equipment is operated in difficult conditions and in emergency situations may be exposed to radiation, it is important to know how to affect the properties of the composites a given radiation, how to avoid the harmful effects of radiation on the products of Plastics, as well as, without destroying structural integrity, to detect internal defects.

As shown by many years of practice and experimentation, the most dangerous effects on composite materials in general (and the GRP in particular) has ultraviolet radiation - invisible zone of the spectrum beyond the violet region. Because the wavelengths of ultraviolet radiation shorter than visible, their photons have more energy, enough to initiate some chemical reactions and destruction (aging) of most plastics.

The use of composites on the spacecraft requires better stability under strong UV radiation. Basically, it was discovered [1], are unstable polyesters, while epoxides and certain types of polyamides meet the stringent requirements of NASA for space materials.

To protect the composites from UV radiation are different coatings, which include UV stabilizers, converting the photon energy into heat [2]. The most common UV stabilizer, entered directly into polyester fiber glass, is a 2-hydroxy-4-metoksibenzofenon (UV = 9). It is administered in a binder in the amount of 0,1-0,8% by mass. The thinner fiberglass, the higher should be the concentration of the stabilizer.

The spectral composition of nuclear power is such that the unprotected composite materials absorb a significant amount of falling on their energy flow. Depending on the thickness of the composite thermal resistance of resin and reinforcement material within its structure, the number and intensity of the absorbed energy, the degree of destruction of the composite material will vary. Experiments carried out using different coatings to reflect the energy of nuclear radiation, show different degrees of damage to the material [3].

Composite materials were kept in conditions of nuclear radiation at different levels. It was found that thermal and fast neutrons and gamma rays are only slightly affect or not affect their physical properties.

Moreover, radiography is one of the nondestructive methods of testing reinforced plastics. It allows you to explore the internal structure of solid materials, making it visible. The sample is placed between the source of penetrating radiation and the registrar of shadow images of the sample, which serves as a photographic film or photographic plates. Inside the pores and breaks the continuity of reducing the amount of solid matter in the way of radiation and, consequently, for films it is possible to locate these injuries, because In these places the radiation intensity is higher and the film is marred stronger.

Radiography is one of the most common methods of nondestructive testing [4]. For staining of surface defects the samples treated tetrabrometanom, opaque to X-rays. This method can determine the size of defects and discontinuities of fibers, provided that the cracks have access to the sample surface.

Radiography can detect defects that are larger than the wavelength of radiation. Defects smaller or perpendicular to the radiation detected with large errors.

Equipment and methods for radiographic testing are described by military specifications MIL-T-271 and standards: ASTM E 94-68, E 142-77, E 568-76.

For X-ray beams with energies higher than conventional X-ray tubes, using the method of bombing a target of heavy metal beams of electrons accelerated in linear accelerator and betatron. Such radiation has a higher penetration capability, it is weakly scattered, and can detect defects in the structure of the material in the deep layers of plastic.

The beta radioactivity (high-energy electrons) can be used to determine the content of binder in fiberglass with an accuracy of 2%. The method is based on the phenomenon of backscatter electrons from a material with higher density (average atomic number of the glass higher than that of the binder) [5]. Radiation in this case reaches depths of up to 500 microns.

The absorption of thermal neutrons by boron present in the E-glass, is the basis of another method of nondestructive testing of the thickness of the Plastic (the number of layers) and the content of components in the material.

Gamma-radiation method is based on the use of sources of cobalt-60, cadmium-109 and cesium-137, with a narrow energy spectrum [6]. Appliances gamma-ray, which can be used to determine changes in the density of materials, based on the ratio:

$I_n = I_0 e^{-\mu r d}$, where

I_n - the energy of radiation passing through the sample per unit time;

I_0 - the energy source of g-radiation, calculated per unit of time;

r - the volume density of the material;

m - linear absorption coefficient;

d - thickness of the sample.

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[PEX and PVC](#)