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Test method of ionizing radiation effect for polymer-based piezoelectric composites

聚合物基压电复合材料电离辐射效应试验方法

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Foreword

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part 1: Structure and Drafting Rules of Standardization Documents". Drafting.

Please note that some content in this document may involve patents. The issuing organization of this document assumes no responsibility for identifying patents.

This document was proposed by the China Building Materials Federation.

This document is under the jurisdiction of the National Technical Committee on Standardization of Fiber Reinforced Plastics (SAC/TC39).

This document was drafted by: Wuhan University of Technology, Tsinghua University, Central South University, Beijing Spacecraft Overall Design Department, and Longzhong Laboratory.

Wuzhen Laboratory, Wuhan University of Science and Technology, Lanzhou Institute of Space Technology Physics, Xinjiang Technical Institute of Physics and Chemistry of Chinese Academy of Sciences, Tianjin Astar Aerospace Tianke Technology Co., Ltd., Peking University School of Stomatology, Peking University People's Hospital, Dongfang Electric (Wuhan) Nuclear Equipment Co., Ltd., Hubei Province Institute of Metrology and Testing Technology The main drafters of this document are: Dong Lijie, Wang Ke, Zhang

Dou, Wang Xiaoyu, Zhou Ling, Ju Yanyun, Yuan Xi, Feng Zhanzu, Sun Jing, Zhao Tingting, and Li Hairong.

Wang Xiang, Zhang Qimeng, Lin Tingqiang, Zhang Yi, Yao Fangzhou, Han Bing, Wang Shidong, Xia Yongfeng, Feng Rui, Wang Zehong, Zhang Yang, Han Ting, Liu Bowei, Pan Meng, Xiong Yufei Wang Haowei, Xu Yixian, Liu Dong, Li Yancun.

Ionizing radiation effect of polymer-based piezoelectric composites Test methods

1 Scope

This document describes the experimental principle, experimental environment, specimens, instruments and equipment, and testing procedures for the ionizing radiation effect of polymer-based piezoelectric composite materials.

Test procedures, test results, and test reports.

This document applies to the determination of the ionizing radiation effects of polymer-based piezoelectric composites. (Keywords. piezoelectric polymer materials, polymer-based piezoelectric composites) Materials and devices should be used as a reference.

2 Normative references

GB/T 11309-1989

GB/T 13992

GB/T 16304-2008

GB/T 43251

3 Terms and Definitions

The following terms and definitions apply to this document.

3.1

Functional materials composed of piezoelectric materials and polymers.

3.2 piezoelectric effect

Piezoelectric materials generate polarization charges under mechanical force (positive piezoelectric effect) or deform under an external electric field (inverse piezoelectric effect). Phenomenon.

[Source. GB/T 3389.1-1996, 4.12, with modifications]

3.3 [Source. GB/T 3389.1-1996, 6.14, with modifications]

The parameter reflecting the coupling relationship between the mechanical and electrical quantities of the piezoelectric effect (3.2) is defined in formula (1). dij= dDi dTj E,Tn dSj dEi T,Em (i,m=1,2,3,m !=i;j,n=1,2,,6,n!=j)(1) In the formula.

dij --- piezoelectric strain constant;

i --- The polarization direction of the material or the direction in which the electric field is applied;

j --- The direction of applied stress or induced strain;

Di --- Electric displacement component, in coulombs per square meter (C/m2);

Tj --- Stress component, in Newtons per square meter (N/m2);

Sj --- Strain component, dimensionless;

Ei --- Electric field intensity component, measured in volts per meter (V/m).

Note 1.The piezoelectric strain constant reflecting the positive piezoelectric effect is the positive piezoelectric strain constant, with units of coulombs per newton (C/N); the piezoelectric strain constant reflecting the inverse piezoelectric effect is...

The constant is the inverse piezoelectric strain constant, with units of meters per volt (m/V). For ease of distinction, the inverse piezoelectric strain constant is usually represented by dij*.

Note 2.The piezoelectric strain constant within the principal plane of the specimen (referred to as in-plane) is denoted by the symbol dij_in; the piezoelectric strain constant perpendicular to the principal plane (referred to as out-of-plane) is denoted by the symbol dij_in.

The symbol dij_out represents this.

3.4 ionizing radiation

Any type of radiation, including charged particles, uncharged particles, or both, such as alpha particles, beta particles, X-rays, gamma rays, neutrons, and matter.

The radiation interacts with the material, ionizing it through initial or secondary processes.

3.5 Total ionizing dose

The energy accumulated per unit mass of material during ionizing radiation.

Note. The SI unit for total ionizing dose is the gray (Gy). One gray is equivalent to one kilogram of a certain material absorbing one joule of radiation energy (1 Gy = 1 J/L).

kg). Another commonly used unit is rad, 1 Gy = 100 rad.

3.6 Dosage rate

The total ionization dose of the material per unit time.

Note. The unit is gray per hour (Gy/h).

4 Experimental Principle

Polymer-based piezoelectric composite material samples were placed in a 60Co gamma-ray ionizing radiation environment, and the samples were tested after being irradiated with a certain total ionizing dose.

Variations in piezoelectric and tensile properties were studied to reflect the ionizing radiation effect of polymer-based piezoelectric composites.

5.1 Performance Testing Environment

Performance testing should be conducted at a temperature of (23±2)°C and a relative humidity of (50±10)%.

5.2 Ionizing Radiation Test Environment

Ionizing radiation was conducted using a 60Co gamma radiation source at a temperature of (23±2)°C and a relative humidity of (50±10)%.

6.1.1 Number of Samples

Each group should have no fewer than 3 valid samples.