

MATERIALS AND STRUCTURES SYMPOSIUM (C2)
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THE RESEARCH OF THE INTEGRATED COMPOUND INSULATOR'S STRAIN FIELD
MEASUREMENT UNDER BENDING DEFORMATION BASED ON DIGITAL IMAGE
CORRELATION METHOD

Abstract

Ceramic Panel Integrated Compound Insulator(CPICI) has advantage of low density, low thermal conductivity, excellent heat-resistant, which has been one of the most important thermal protection structure system in high speed vehicles design. Before the thermal protection structure design, engineers need the CPICI' maximum strength value, like failure strain. In early stage, the traditional electrical method(Strain gage) is used for measuring the CPICI's strain under the bending deformation load, while some issues have appeared frequently, including: 1) Electrical method could not obtain the full-field strain on the CPICI' surface. 2) It is hard to predict the failure location on the CPICI. 3) The strain gage is likely part-bonding or even unstuck with CPICI, leading to the measuring strain value distorted. Digital Image Correlation Method(DICM) is noncontact full-field optical measurement method,obtaining the strain field value of the object region correctly. This paper takes advantage of DICM and carries out the research of CPICI' strain field measurement under bending deformation. CPICI' bending deformation is obtained by four-point bending load method. Step loading method is adopted in the test, with 1mm/min loading rate, and the CPICI' surface photo is taken every 200N. At the same time, six strain gages are stick to the surface of the CPICI, which are only taken as control group.The author keeps loading until the CPICI's failure, and compares the Exx strain value of Strain gage and DCIM in the whole test. From the test results, some conclusions can be reached: 1) The strain gage can only measure independent point' strain data, while DICM can exactly measure the strain field of CPICI surface under bending deformation effectively, and show the high strain region, strain distribution and strain value everywhere on the surface clearly; 2)The strain gage can hardly measure the strain value of the failure location, while DICM can exactly get it; 3)The strain gages value is always smaller than the DCIM', and the relative error result is opposite, so it is clearly that DCIM' value has smaller dispersion, and higher reliability.