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Study of a New Composite Material Rt800 Reinforced with Polyte 440-M888 in Endurance Conditions

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Abstract

This paper aim to determine the analytical form of the Wöhler function F which is associated with the behavior of the composite material made of polyester resin reinforced with 5 layers of glass fiber fabric, RT800, with the specific mass of 845g /m^2, reinforced with Polyte 440-M888.

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Keywords: endurance stress testing; composite materials; Wöhler function; glass fiber fabric.

1. Introduction

The study of the composite laminate is presented in many paper (i.e. [1]-[8]) and the properties of such materials are calculated. The mechanical identification of these materials are presented in the papers [9]-[13]. A long series of papers studies the mechanical properties of the materials (i.e. [14]-[37]). The durability problem for a mechanical component can be no longer approached without knowledge of operating data, along with the knowledge of the behavior of the component's material from an endurance point of view. Considering the fact that both the stresses and the materials strengths have, in almost all the cases, a random particularity, the analytical approach regarding

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fatigue and wear can only be made from a probabilistic point of view, by knowing the probability P which is associated to a pair of values (σ, N) of the Wöhler function:

$$P=F(\sigma , N) \quad (1)$$

where σ represents the stress and N represents the number of cycles until the material tears.

In order to determine the analytical form of the function F, we need to perform a series of endurance tests, on a sufficiently high number of specimens, at different levels of amplitudes of the stresses, with a constant asymmetry of cycle's coefficient. In this paper, we will analyze (using the approach described above) the behavior of a RT800 composite material in endurance testing and we will find the continuous Wöhler function F associated with this material. Finding the analytical form of the Wöhler function is very important in estimating the life of mechanical components, using damage accumulation hypothesis like Miner, Corten-Dolan etc.

2. Material and method

The specimens which were used for endurance testing were obtained from a composite material board made of polyester resin reinforced with 5 layers of glass fiber fabric, RT800, with the specific mass of 845g /m^2. The specimens have the following physical characteristics:

- the length of the specimen (A) is 100mm;
- the width of the specimen (B) is 10mm;
- the thickness of the specimen (C) is 4.5mm.

The endurance testing was developed for bending stresses. The specimens were designed as in the Fig. 1.

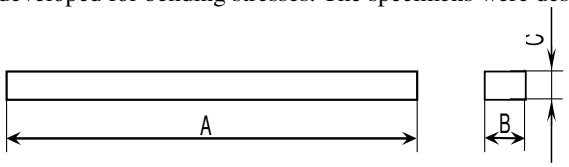

Fig. 1. The shape of the specimens which were used in endurance testing

For endurance testing, we used the following setup and method: The specimen is placed on two supports, as a lever, and is forced into alternating symmetric bending, until tearing. The method can be easily understood from Fig. 2. The distance between the fixed pairs of cylindrical supports is 80mm, and the force F is applied in the middle of the specimen, in an alternating manner.

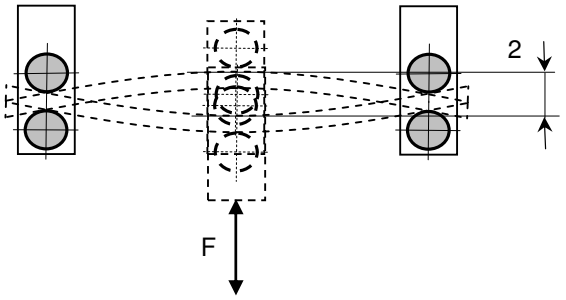

Fig. 2. The bending process in three points

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