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BALLISTIC BEHAVIOUR OF PVC-FOAM SANDWICH STRUCTURES

Brenda L. Buitrago*, Shirley K. García-Castillo*, and Enrique Barbero*

*Department of Continuum Mechanics and Structural Analysis
University Carlos III of Madrid
Avda. de la Universidad 30, 28911 Leganés, Madrid, Spain

e-mail: bbuitrago@ing.uc3m.es, web page: http://www.uc3m.es/mma

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Summary. *In this paper the ballistic behaviour of sandwich plates with PVC core was analysed by means of experimental tests and an analytical model. The influence of the core in the threshold velocity and damage area of the structure was studied.*

1 INTRODUCTION

One of the parameters that can be used to estimate the strength of a structure to a ballistic impact is the threshold velocity, above which a perforation of the component takes place. The threshold velocity in sandwich structures can be determined by means of experimental tests, analytical models or numeric models. The number of analytical models developed to determine this parameter in structures sandwich is much smaller that those developed for laminate plates [1-2]; among other reasons, for the presence in the sandwich of materials with very different acoustic impedance (skin and core) that complicates the development of these models. In this research the threshold velocity and damage area of a E-glass/polyester sandwich plate were studied. The viability of the use of the models proposed in [3], developed for woven laminates, to calculate the residual velocity in the sandwich was evaluated.

2 EXPERIMENTAL PROCEDURE

Sandwich plates with E-glass/polyester woven laminate skins and a PVC-foam core were selected. The results of the impact tests were compared with a structure made by two skins of the same material that the sandwich at the same distance (designated sandwich air core).

3 THEORICAL MODEL

The model used by García-Castillo et al [3] is based in energetic criteria and consider four energy absorption mechanisms (the kinetic energy, tensile failure of the primary yarns, elastic deformation of the secondary yarns, delamination damage and matrix cracking). This analytical model was validated with experimental test and numerical simulations for glass/polyester laminates [3], and allows the estimation of the residual velocity of the projectile, the threshold velocity, the energy absorbed during the penetration of the laminate and the contact time between the projectile and the plate. In this works the model is applied to the sandwich plate twice, once for the front skin, and other time for the back skin.

4 RESULTS

The ballistic behaviour of the sandwich air core is similar to the sandwich PVC core, as can be seen in figure 1. The threshold velocity of the sandwich air core is 334.92 m/s, close to that of the sandwich PVC core which is 328.92 m/s. Considering this result the model in [3] was applied to calculate this parameter, being obtained a value of 333.47 m/s, therefore the difference between experimental and theoretical values is 1 %. On the contrary it was observed that, in the front face, the sandwich air core presents a bigger damaged area compared with the sandwich PVC core. In the back face the behaviour is the opposite.

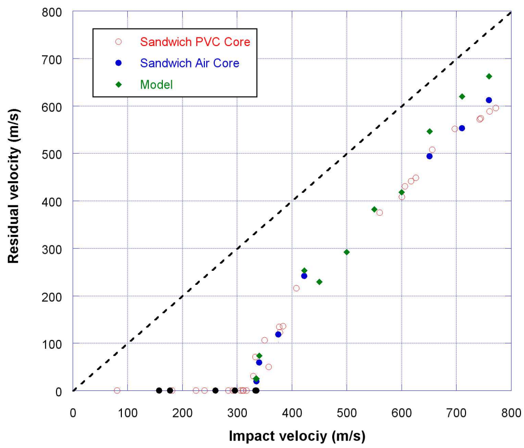

Fig. 1 Residual velocity vs. initial velocity

5 CONCLUSIONS

There is not significantly influence of the core in the threshold velocity of the sandwich plates. Therefore it is possible to use a model designed for laminates to estimate this variable with a reasonable error. The damage generated by the impact is affected by the presence of the core, reducing the damage area in the front face and increasing it in the back face, regarding the case that the core doesn't exist.

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