SUMMARY

The energy-absorbing composites have been subjected to specific exposure to impact loads and have a protective function for shielded components in 'failure' situations where there is accidental or intentional mechanical or dynamic action.. The energy-absorbing properties of composite materials are used extensively in the aviation and marine industries, but solutions are being sought to use them also in the automotive or other transport industries.

Improvements of materials and the availability of apparatus enabling strength, mechanical, thermal, including fatigue tests of layered structures , allow a dynamic development of research work confirming the effectiveness of the use of structural composites as energy-absorbing structures. The right selection of materials and project, production technique, as well as repair and maintenance strategies can guarantee the production of highly efficient composite structures.

In this doctoral thesis, an epoxy-glass layered composite with a modified matrix and porous core was designed and fabricated, and damage mechanisms and strength characteristics were analysed. Experimental studies carried out were proposed as a basis for the development of a test procedure for the comprehensive strength and mechanical characterisation of the composite for use as a protective structure in electric cars. The realisation of the objectives included:

- a literature analysis and study of energy-absorbing composites, the materials applied to their production, strength tests and application directions.
- the preparation of a layered material with a chemically modified matrix constituting an element of innovation as a factor determining impact energy absorption properties.
- characterisation of the quantitative and qualitative effects of material selection and matrix modification on impact, bending, compression, impact resistance and residual strength, and dynamic mechanical analysis of the composite layer in the range of low and high temperatures.
- analysis of the failure mechanisms of epoxy-glass layered composites with lightweight core and the interaction of the components under the loads during the proposed experimental tests.

Joanna Marzewicz