

SOME FAILURE MODES OF POLYLITE 440-M888 POLYESTER RESIN REINFORCED WITH RT300 ROVING FABRIC SUBJECTED TO TENSILE LOADINGS

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Abstract: The paper presents some failure modes occurred in tensile tests of Polylite 440-M888 polyester resin specimens reinforced with RT300 roving fabric, specimens that have been cut in warp direction of the reinforcement. Tensile tests results are also presented. The first failures of the specimens took place in the form of inter-fibers brake at a strain of about 0,03.



Keywords: roving fabric, polyester resin, polylite 440-M888, failure modes, polymer matrix composites, glass fibers

1. MATERIAL'S FEATURES USED IN TENSILE TESTS

The composite material used in tensile tests is a thermosetting polymer, namely polyester resin of type Polylite 440-M888 reinforced with 12 layers of RT300 roving fabric ($315 \pm 10\%$ g/m² specific weight and $0,3 \pm 0,05$ mm thickness of each layer). Generally, the RT roving fabrics are obtained from E-glass fibers with continuous filaments, with cutted edges and reinforced with Dreher weave [1].

These fabrics are used with polyester- and epoxy resins and present good impregnation properties. The application areas of these fabrics are in electrotechnical-, chemical-, constructions- and aeronautics industry.

2. SPECIMENS

The specimens based on Polylite 440-M888 polyester resin reinforced with 12 layers of RT300 roving fabric have been manufactured very accurately at Compozite Ltd. Brasov, Romania, according to the standard SR EN ISO 527-1: Determination of tensile properties of fiber reinforced composite materials (see fig. 1). These specimens have been cut in warp direction of the reinforcement, from a plate of about 4 mm thick, tempered at 20°C before the tensile tests and subjected to tensile loading until break occurs.

The tensile testing machine is produced by Lloyd's Instruments, UK, (type LS100) and presents the following specifications [2]:

- force range: 100 kN;
- speed accuracy: <0.2%;
- travel: 840 mm
- load resolution: <0.01% of loadcell used;
- extension resolution: <0.1 micron;
- loadcell: XLC-100K-A1;
- analysis software: NEXYGEN MT.

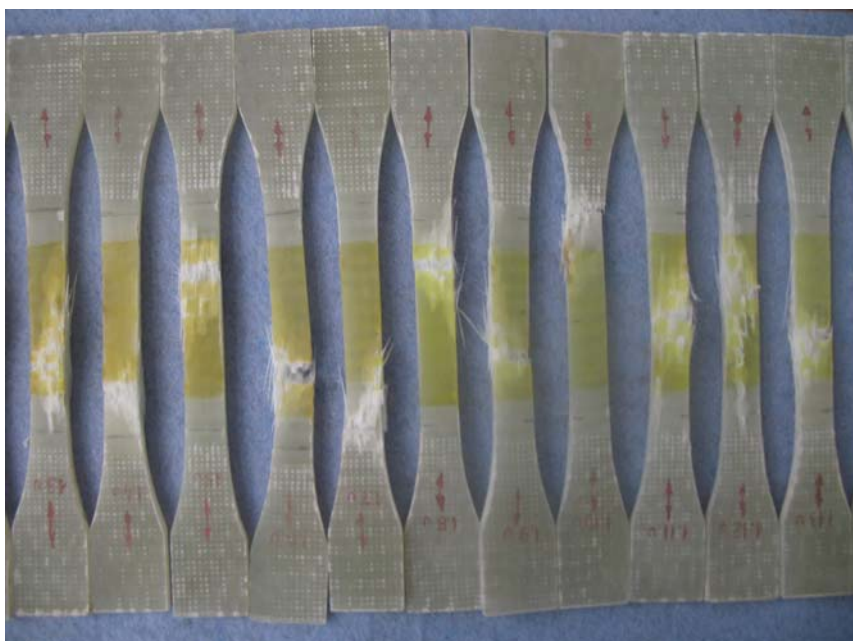


Fig. 1. Specimens based on PolyLite 440-M888 polyester resin reinforced with 12 layers of RT300 roving fabric, specimens cut in warp direction of the reinforcement and subjected to tensile loading until break

3. TENSILE TESTS RESULTS

The maximum and minimum tensile tests results of 15 specimens based on PolyLite 440-M888 polyester resin reinforced with 12 layers of RT300 roving fabric, specimens cut in warp direction of the reinforcement are presented in table 1.

Table 1. Tensile tests results

	Maximum	Minimum
Number of specimens	15	15
Gauge length	55 mm	50 mm
Preload stress	0,0058 kN	0,0056 kN
Preload stress speed	21 mm/min	21 mm/min
Speed	1 mm/min	1 mm/min
Width	10 mm	9 mm
Thickness	3,6 mm	3,2 mm
Area	35,626 mm ²	28,8 mm ²
Limit	100 mm	100 mm
Load at maximum load	12,942 kN	9,936 kN
Load at minimum load	- 0,072479 kN	- 0,16022 kN
Stress at maximum load	397,25 MPa	278,91 MPa
Strain at maximum load	0,075527	0,062202
Strain at minimum load	0,078544	0,062426
Load at minimum extension	0,0038147 kN	- 0,0038147 kN
Stress at minimum extension	0,11133 MPa	- 0,11236 MPa
Load at break	12,926 kN	9,9266 kN
Stress at break	390,53 MPa	278,64 MPa
Strain at break	0,075570	0,062356
Tensile strength	397,25 MPa	278,91 MPa
Extension at break	3,8399 mm	3,3129 mm

4. FAILURE MODES

The first specimens failures have occurred at a strain of about 0,03 and took place in the form of inter-fibers brake. The effect of inter-fibers brake is not so spectacular as in the case of specimens based on PolyLite 440-M888 polyester resin reinforced with chopped strand mat CSM600. The crack that primes the inter-fibers break take place on a smaller length than in the case of specimens reinforced with CSM600. Some failure modes of specimens based on PolyLite 440-M888 polyester resin reinforced with 12 layers of RT300 roving fabric, specimens cut in warp direction of the reinforcement are presented in fig. 3 – 7.



Fig. 2. Front view 1 of the failure mode



Fig. 3. Front view 2 of the failure mode



Fig. 4. Front view 3 of the failure mode



Fig. 5. Lateral view of the failure mode

REFERENCES

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