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MICROSCOPIC ANALYSIS FOLLOWING BENDING OF MAT AND ROVING TYPE COMPOSITE MATERIAL

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Abstract: *Microscopic analysis can be both an intermediate and a final control method. Its importance is as high as this method is easy and does not require special equipment, a large number of parts being controlled. By this metallographic analysis, information concerning manufacturing technology, the multilayer aspect, type of structure, weft and warp structure can be obtained.*
Keyword: *material section, MAT-Roving fabric, 2D and 3D visualization, detailed analysis*

1. MACROSCOPIC ANALYSIS

By macroscopic analysis the faults occurred in different manufacturing technological stages can be highlighted, namely: capacity faults (retouches, porosities, cracks), at the surface or in the depth of the product; these are different in nature (genesis), size, relative distribution (concentrated or dispersed) and may represent products rejection causes.
Acclaim system is a manual video camera with USB plug, 1/4 Inch CCD sensor; automatic exposure control; normal image, non-mirrored; 1,3 megapixels; capacity of magnifying 5 times the studied material.
The microscope meets the requirement of decreasing evaluation time and also improving quality by observing an entire image in real time just by turning the adjustment button while the studied part is observed.
Accurate images can be created within the depth of the observation field, by correcting edge deviations. It adjusts the edges displacement due to the displacement of the focusing position of an optical non-centric lens. A 3D image can be immediately displayed by moving the lens downwards.

Figure 1 VHX microscope

Figure 2 Video camera during analysis

2. MICROSCOPIC ANALYSIS OF THE MATERIAL STRUCTURE

In order to study the changes occurred in the composite material, 2 efficient devices were used: video camera and VHX microscope. After they were subjected to bending, the specimens were magnified by help of the above

presented devices and studied in the breaking area (video camera magnified 5 times the area and the VHX microscope magnified it 500 times).

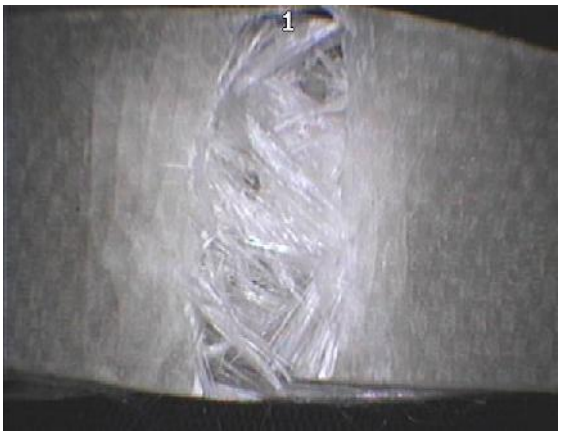

Figure 3 Specimen 2 MAT-Roving magnified 5 times by video camera

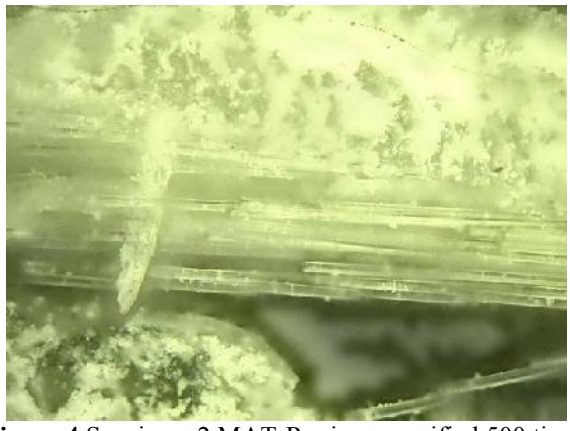

Figure 4 Specimen 2 MAT-Roving magnified 500 times by 2D microscope

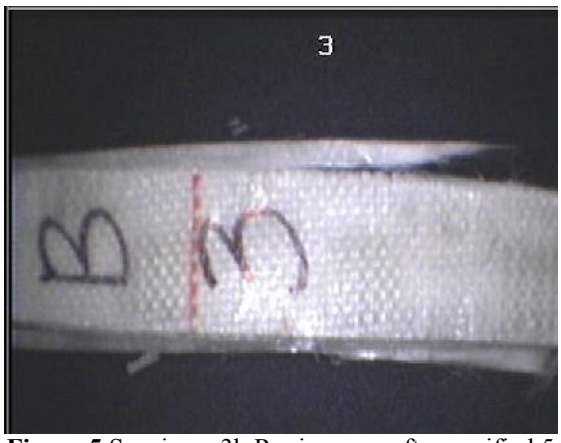

Figure 5 Specimen 3b Roving on weft magnified 5 times by video camera

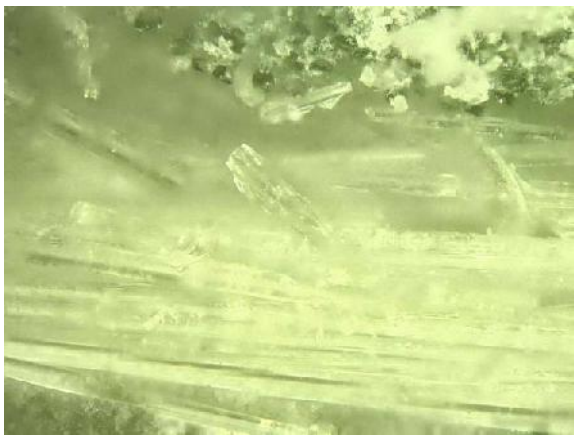

Figure 6 Specimen 3b Roving on weft magnified 500 times by 2D microscope

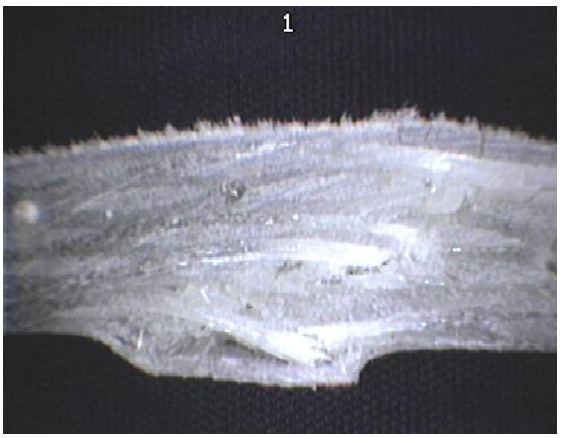

Figure 7 Specimen b4 Roving on weft magnified 5 times by video camera

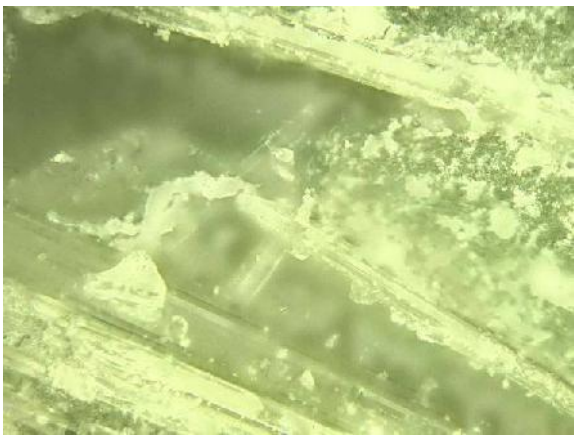

Figure 8 Specimen b4 Roving on weft magnified 500 times by 2D microscope

If there are internal stresses in the composite materials reinforced with fibres, with higher values than those admissible, then during their use even a low load may damage irreversible the composite. Following the researches performed by now, it comes out how important are the precautions for diminishing the cracks creation risk. A representative method is the multilayer composite pre-tensioning namely introducing internal stress in composite, in order to increase its cracking limits.

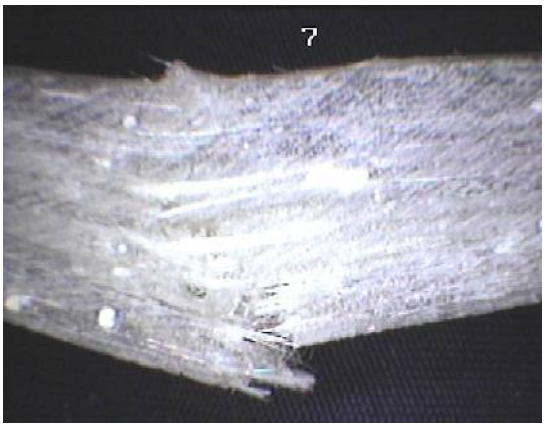

Figure 9 Specimen u5 Roving on warp magnified 5 times by video camera

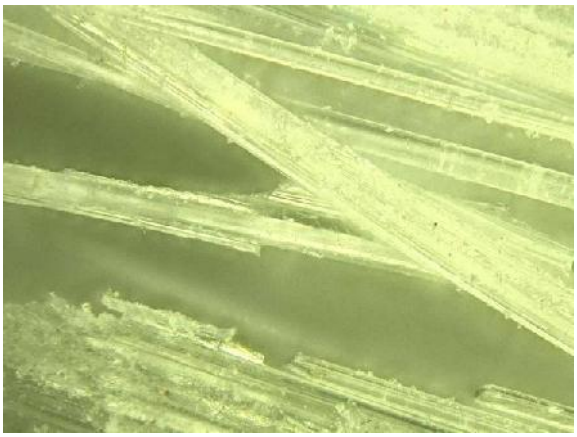

Figure 9 Specimen u5 Roving on warp increased 500 times by 2D microscope

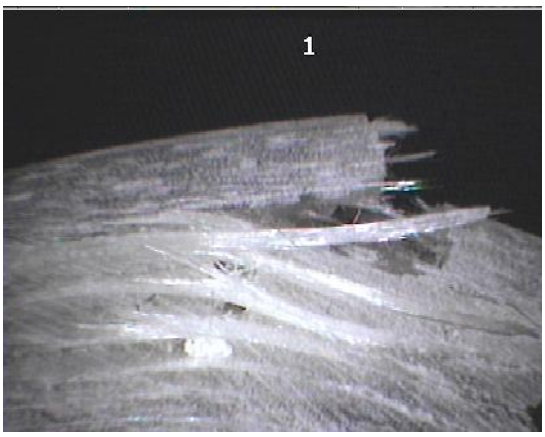

Figure 10 Specimen 5 MAT-Roving magnified 5 times by video camera

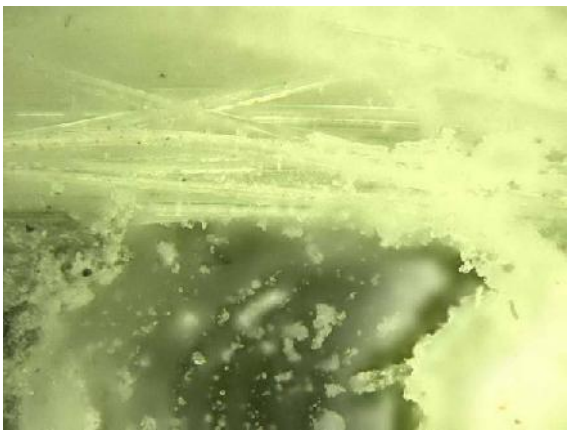

Figure 11 Specimen 5 MAT-Roving increased 500 times by 2D microscope

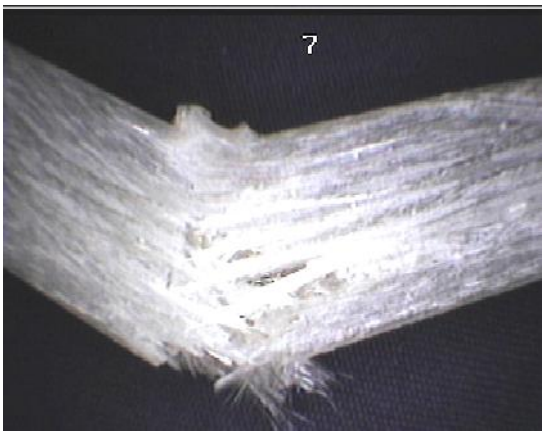

Figure 12 Specimen 8 MAT-Roving magnified 5 times by video camera

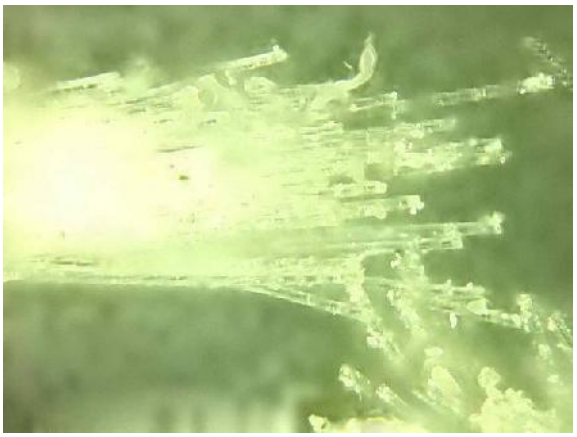

Figure 13 Specimen 5 MAT-Roving increased 500 times by 2D microscope

3. CONCLUSIONS

The extreme complexity of some products, continuous appearance of new models and scientific theories that change the approach of the technologic act itself, makes anything to require a high concentration of material and conceptual forces

Thus, some specimens made of the above presented materials were studied, being able to analyze the layered structure, material damage, distribution of filling materials, non-uniformities that might occur.

Performing microscopic researches lead to a detailed analysis of the material, its faults, breakage as follow of different loads, specifically thrust and bending, which usually produce damages both at fibre level and at matrix level.

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