# 4.5.24. ULTRASOUND AND EDDY CURRENT NONDESTRUCTIVE EVALUATION OF CFRP – CORRELATION WITH MECHANICAL PROPERTIES OF THE COMPOSITES

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Carbon fiber reinforced plastics (CFRP) composites have remarkable properties and low density. This recommends them for different use from sport goods to aeronautic industry. CFRP degradations are due, specially, to the delamination induced by impacts, thermal destruction of matrix pursuant to local heating at temperatures that exceed the point of glass transition, the effect of water absorption in the matrix.

CFRP plates with 1.91mm and 3.80 mm thickness having 6 and respectively 12 harness satin weave T300JB type with 285 g/m$^2$, $[0°, 90°, 45°]_S$ layout and fiber volume fraction 50 ± 3% have been taken into study. The matrix is from polyphenol sulphate. The measurements of mechanical and thermal properties of CFRP were effectuated with Dynamic Mechanical Analyzer DMA 242C Netzsch Germany, the nondestructive ones were made by eddy current using Network/Spectrum/Impedance Analyzer Agilent 4395A with a focused eddy current transducer with orthogonal coils and with ultrasound using Phasor XS General Electric USA and 5073 PR Pulse Receiver – Panametrics coupled with a digital oscilloscope LeCroy – Wave Runner 64Xi.

The CFRP samples were impacted with energy impact between 1 and 6J, using a spherical impactor with 22 mm diameter.

The thermal degradation was created by local heating with hot air, so that the glass transition was exceeded, figure 1. The effect of water absorption in matrix was followed, the samples being immersed in water and their mass was measured before and after this.

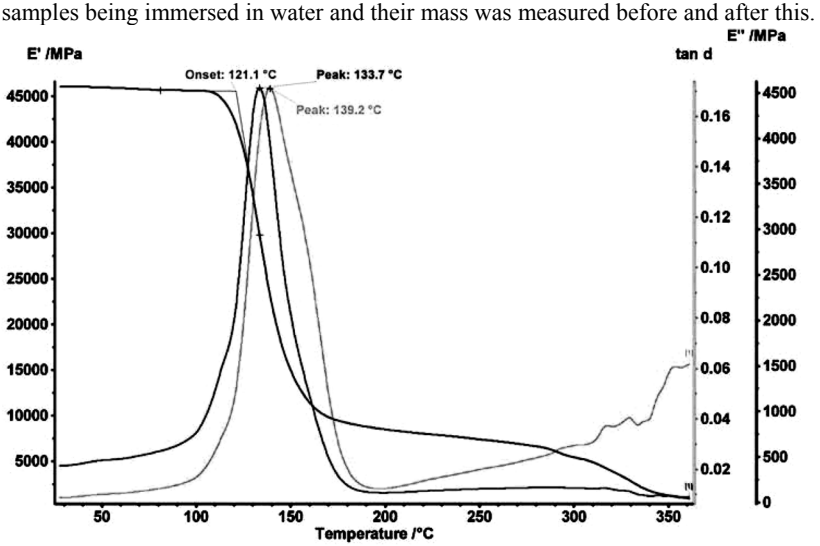


**Fig. 1. Dynamic Mechanical Analyses**

The delaminated zones and those thermal degraded were examined both by eddy current and ultrasound – time of flight C scan.

In figures 2 and 3 are presented an eddy current record of a delaminated zone due to an impact with 2.5 J and respective, the C –scan ultrasound.

After the nondestructive examination by the above mentioned methods, the samples were destructive examined by Dynamic Mechanical Analyses, the decreasing of elasticity modulus reported to the area of delaminated and thermal degraded surface being obtained.

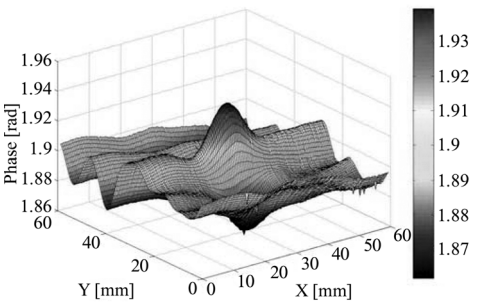


**Fig. 2. Eddy current signal at the scanning**

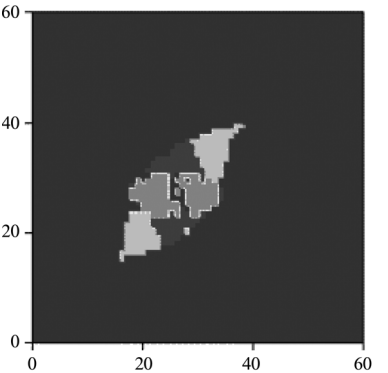


**Fig. 3. C-scan ultrasound over a delamination**

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