NANOCOMPOSITES POLYMER-NANOCARBON AND POLYMER-NANOCLAYS AS ADVANCED MATERIALS FOR STRUCTURAL APPLICATIONS

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Motivation: — Through the use of nanofillers, either alone or in conjunction with micro-scale-structures, the quality of the structure increases with decreasing dimensions
— Additional interaction with carbon fibres could lead to superior properties of the performed composites

Objectives: The achievement of:
— epoxy-based composites reinforced by nanostructured organic/inorganic materials like laser-synthesized carbon nanopowder or montmorillonite-type clays.
— structural composites having as matrix one of above mentioned composites and additionally reinforced by carbon or glass fibres tissue.

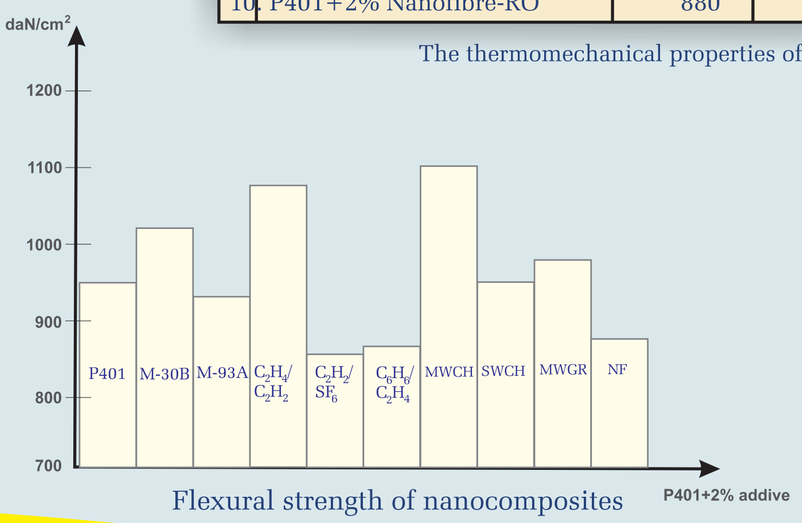
The characterisation of nanocomposites

No	MATERIAL	Flexural Strenght daN/cm^2	Shore Hardness	Thermal Stability °C	Obs.
1.	P401	950÷1000	75	50	
2.	P401+2% Montmorillonit 30B	1025	83	56	
3.	P401+2% Montmorillonit 93A	922	83	56	
4.	P401+2% C_2H_2/C_2H_4	1088	81	59	
5.	P401+2% C_2H_2/ SF_6	850÷900	79	56	Porous
6.	P401+2% C_6H_6/ C_2H_4	860	79	56	
7.	P401+2% MWNT-CHINA	1102	85	59	
8.	P401+2% SWNT-CHINA	960	77	55	Porous
9.	P401+2% MWNT-RO	980	77	55	Porous
10.	P401+2% Nanofibre-RO	880	78	55	Porous

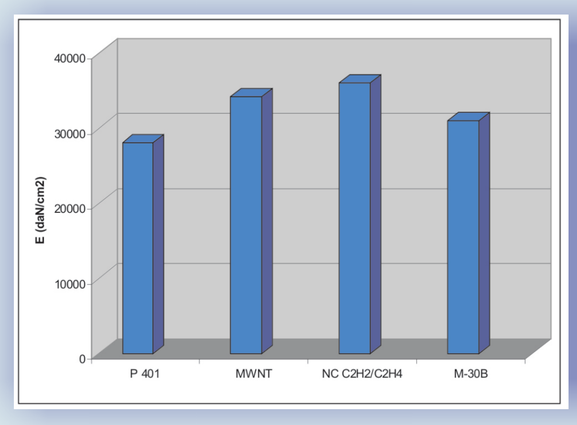
The thermomechanical properties of nanocomposites

No	MATERIAL	Flexural modulus $x10^4$
1.	P401	2.8
2.	P401+2% MWNT	3.42
3.	P401+2% NC C H /C H 2 4	3.60
4.	P401+2% Montmorillonit 30B	3.1

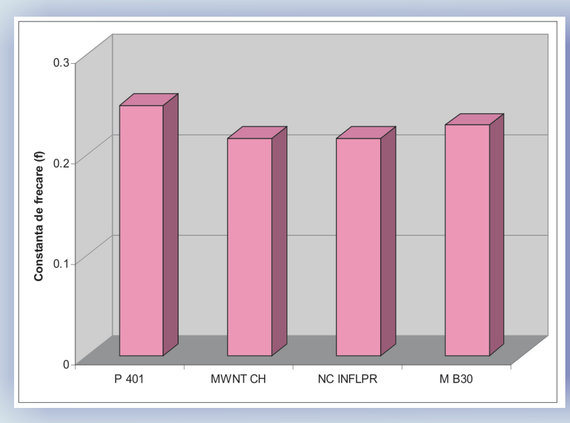
The tensile strength of nanocomposites with 2% nanoffilers



Flexural strength of nanocomposites

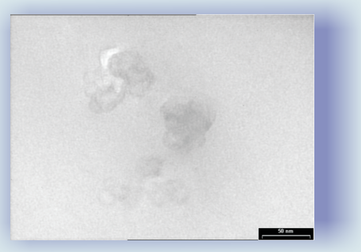


Flexural modulus

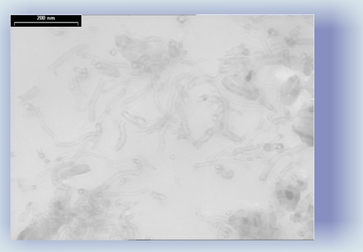


Friction coefficients of nanocomposites P401+2% additives

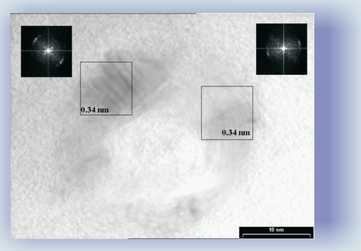
TEM analysis of nanocomposites



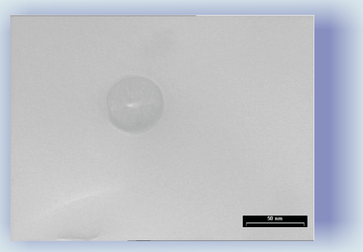
Nanoparticle details



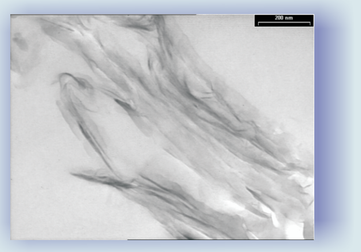
TEM image of MWNTs



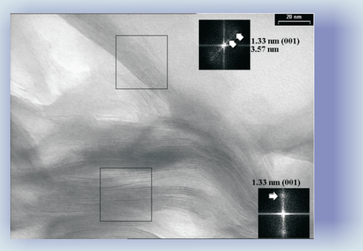
The cross section of MWNTs



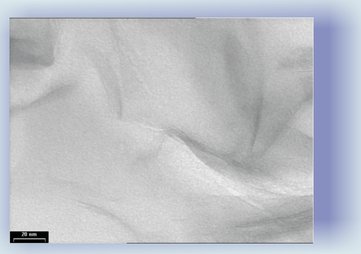
The cross carbon section of a nanofibre



TEM image of polymer +montmorillonite

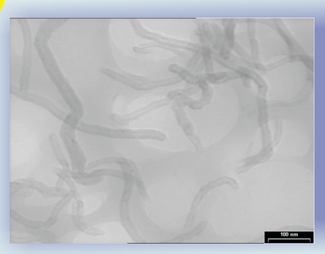


HRTEM image of polymer+montmorillonit

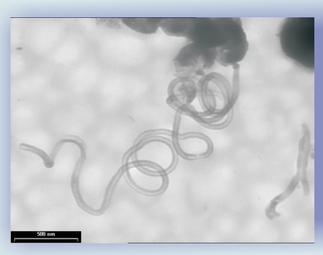


TEM image- delamination of montmorillonite

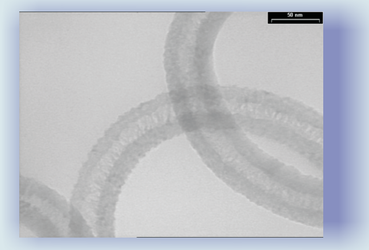
Structural analysis of nanocomposites



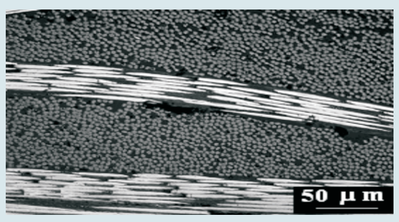
MWNTs



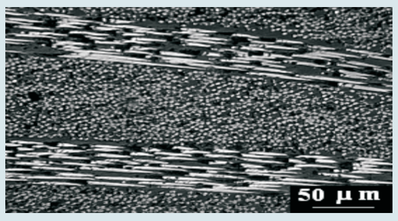
TEM image of carbon nanofibres



TEM analysis of carbon nanofibres - tubular structure



Optical images (X200) representing a sample of carbon fibre/epoxy matrix with 2% nanocarbon (C_2H_2/C_2H_4)



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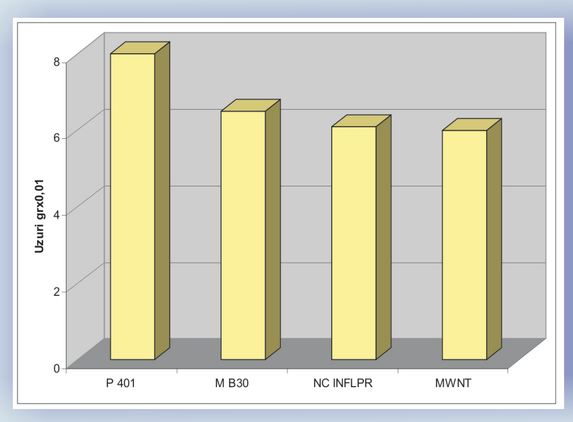

Wear of nanocomposites P401 + 2% nanofillers

CONCLUSIONS

- **characteristics of the obtained nanocomposite are affected by properties and dispersion of the addition material;**
- **the morphology of the carbon nanopowder depends on both gas mixture and experimental parameters;**
- **optimal concentration of the filler was around 2% (wt);**
- **epoxy/nanostructured filler (nanocarbon layered clay) composites show superior mechanic and tribologic characteristics;**
- **better results obtained by addition of laser-synthesized carbon nanopowder;**
- **spectacular decrease of water absorption when nanocarbon and layered clays were added;**
- **the additional reinforcement with carbon/glass fibres led to an important enhancement of mechanic characteristics;**
- **the studies are in progress.**

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