

Proposed Project 3 Mechanical Testing of Polymer Nanocomposites

Objectives

The objective of this project is characterization of the mechanical properties of polymer nanocomposites (PNC) and effects of their nano-sized filler particles (natural and synthetic clays) on the time-dependent properties of the base polymer by determining their quasi-static, dynamic, fracture properties, and nano-indentation behavior.

Background and Standardization needs

Standards, ISO 43 and ISO 17043 related to Linear Elastic Fracture Mechanics (LEFM) approaches to determine fracture toughness and tension-tension (mode I) fatigue crack propagation will be targeted. These measurements are used to determine the resistance of a material to fracture or to crack propagation in the presence of a sharp crack under mode I conditions where a plane strain prevails at the crack tip and the plastic zone size (i.e., non-linear viscoelastic) is small compared to the non-deformed specimen dimensions. These measurements may reflect the relation between stress that may lead to crack propagation and the defect

size for an in-service material component under similar stress conditions. Other modes of crack loading [shear (or mode II) and torsion (mode III)] may also be considered using this approach, although these have not been standardized.

Work Programme

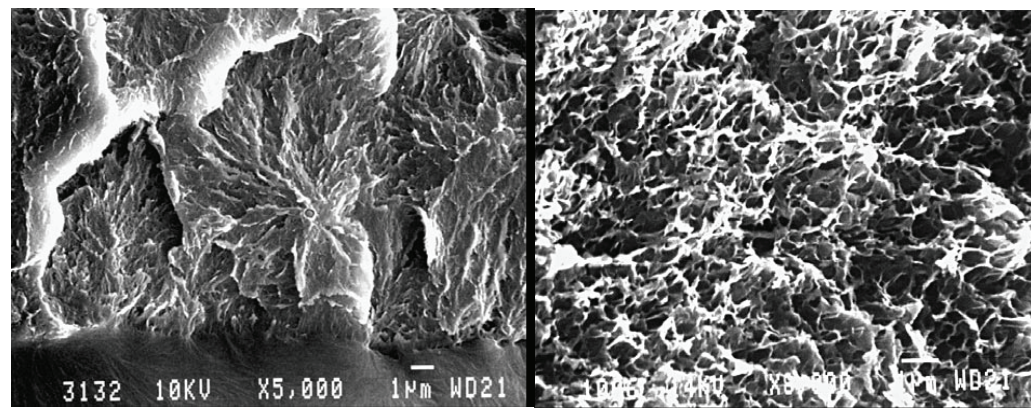
Initially the project will use neat polyamide and the one with organoclay.

The tests:

- Fracture mechanics (fracture toughness, and fatigue crack propagation) of PNC including fractography
- Nano-indentation
- Analysis of suitability of dynamic tests as a replacement for large scale tensile tests.

In addition to standard quasi-static tensile testing of LEFM measurements and verifications of test validity, the protocol shall include the required microstructural analysis to capture PNC main features (nano-filler dispersion, nano-filler intercalation /exfoliation, matrix crystallinity etc.) using known techniques (XRD, HRTEM, AFM, etc.).

Call for Participation



Micrographs: Fracture surfaces of PA-6 (left) and its PNC with 2 wt% organoclay

Deliverables and Dissemination

- VAMAS Technical Report
- Publications in scientific journals and proceedings of international nanocomposite congresses
- Communications and reporting to the ISO TC 229 aimed at development of ISO standard
- Communication and reporting to the ISO / TC 61 / SC 2
- Communication and reporting to the ISO TC 164/SC 3

Funding

Participation is based on in-kind contributions from the partners. Expressions of interest sought.

Status

Proposed to the VAMAS Steering Committee. Awaiting for approval.

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