



Polymer Nanocomposites

Technical Work Area 33

An opportunity to get involved in International Standardization

Introduction

The objective of the VAMAS Technical Work Area on Polymer Nanocomposites (TWA 33) is to support trade through international collaborative projects aimed at providing the technical basis for harmonized measurements, testing, specifications and standards for these advanced materials.

The Polymer Nanocomposite (PNC) is composed of two main components, polymeric matrix and nano-particles. However, since these two are usually thermodynamically immiscible, addition of surfactants and compatibilizers is a rule.

Background and Standardization Needs

The worldwide use of Polymer Nanocomposites (PNC) in diverse industries (e.g., transportation, packaging, coatings and surface treatment) is large and it grows rapidly. However, there are no internationally recognized standards for PNC testing. To design a product one must know the characteristics of the material, its processability, changes induced by processing and longevity. While standard test procedures are well known for the polymers and customary

additives, they are unknown for the nanoparticles. The main goal of TWA PNC is to standardize the essential experimental test methods for PNC, nanoparticles and the products.

Work program

The current program focuses on the most industrially relevant types of PNC, containing clay nano-particles. At present the work is executed as round robin tests in two Projects.

Current Projects

1. Determination of the shape, size and size distribution of nano-filler particles

Technical topics:

1. Determination of the size, shape and their distribution for natural and synthetic clays.
2. Determination of atomic compositions
3. Determination of impurities

The test procedures are being revised on the basis of the obtained results for the natural and synthetic sodium clays. The future tasks will include analysis of clay platelets attrition during compounding and processing.



Figure 1: Toyota and Mitsubishi engine covers and gasoline tank injection-molded from PA-6/clay polymeric nanocomposites

2. Electrical characterization of polymer nanocomposites

Technical topics:

1. DC polarization and conductivity
2. Space charge distribution measurements with Pulsed Electroacoustic Technique
3. Surface erosion due to partial discharges
4. Dielectric loss measurements (low/high voltage conditions)
5. DC and AC dielectric strength

The tasks are being examined using the preliminary data for the polypropylene-based PNC films.

Projects in Preparation

3. Mechanical testing of polymer nanocomposites

Proposed technical topics:

1. Analysis of suitability of dynamic tests as a replacement for large scale tensile tests
2. Fracture mechanics of PNC including fractography
3. Quasi-static and dynamic creep, relaxation and impact tests.

Deliverables and Dissemination

- VAMAS technical reports
- Open literature publications
- Draft text for submission to ISO and IEC for standardization

Ideas for new TWA 33 activities are always welcome

For more information on projects and participation please contact:

Prof: Leszek Utracki
Chair, VAMAS TWA 33
National Research Council Canada
Email: leszek.utracki@cnrc-nrc.gc.ca

or

Prof. Giovanni Camino
Co-Chair, VAMAS TWA 33
Politecnico di Torino,
Email: giovanni.camino@polito.it

www.vamas.org

October 2009