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FABRICATION AND TESTING OF ELECTROACTIVE THERMOPLASTIC NANOCOMPOSITES

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Summary: During recent years, there has been a growing demand for smart functional materials possible to replace nowadays used structures. The main idea is the development of materials with reduce weight but with improve electrical and mechanical properties. One of the most promising substitutes for traditional materials are nanocomposites consist of polymers and filler with nanosize. As a nanofiller the multi-walled carbon nanotubes were chosen due to their outstanding properties and possibility to reach the functionality of composites. In turn owing to polymer part nanocomposites can be processed in commonly used techniques giving various form of ready product such as pellets, films, strands etc. However, sometimes the processability of thermoplastic nanocomposites brings some obstacles resulting from significant increase in viscosity of polymer after carbon nanotubes addition. Hence, a lot of efforts is put to overcome these obstacles to find the possible way of nanocomposite's processing on industrial scale.

The conducted research are focused on fabrication and characterization samples from thermoplastic nanocomposites with carbon nanotubes. They are obtained according to mechanical methods like extrusion or three rolls milling. Polymers used in the study are commercially available copolyamides or styrenic block thermoplastic elastomers in turn multi-walled carbon nanotubes are supplied from Nanocyl, Belgium. All of the nanocomposites are characterized mainly by their electrical conductivity. The influence of process conditions on electrical properties and their reflections in state of dispersion is taken under account. Light , Transmission and Scanning Microscopes are used to find these relations. Additionally, the changes in polymer crystallinity content after carbon nanotubes addition is measured and related with electrical conductivity values.

In order to apply the nanocomposites in the industry it is necessary to develop the fabrication techniques appropriate for bigger scale and dependent on the sectors where they could be utilized. Aerospace and aviation fields are mainly under our interests because the smart lightweight nanocomposites with enhanced electrical conductivity are still desired. Therefore, the long term target is processing of nanocomposites based on tested copolymers towards final product such as fibres, non-woven fabrics or as sandwich structures of dielectric elastomers.