ABSTRACT

This final year project deals with the synthesis and characterization of polymeric foams with nanoscale additions, more precisely carbon and halloysite nanotubes in various compositions, with the objective of obtaining new materials with improved properties for novel applications. After a literature review on the characteristics and properties of polymeric foams and carbon/halloysite nanotubes – the two major constituents of the nanocomposite – there is a detailed presentation of the methods of synthesis and characterization of the nanocomposite polymeric foams.

The morphological characteristics of the microstructures have been quantified through scanning electron microscopy images, the physical properties through weight/dimension measurements, the hydrophobic characteristics through contact angle measurements and the mechanical properties through a uniaxial compression experimental set-up that was assembled for the purposes of this project within the Nano/Micro Mechanics Laboratory of Cyprus University Technology.

The mechanical elastic response of the synthesized polymeric foams is contrasted to analytical models that are found in the literature as well as with computational simulations with finite element method that have been implemented within the activities of this final year project.

In conclusion, the nanocomposite polymeric foams offer improved mechanical and hydrophobic properties, which establishes them as ideal candidates for applications where the strength/weight–ratio and waterproof nature of the material is at stake.

The works of this thesis have been executed in the Nano-/Micro Mechanics of Materials Laboratory and the Research Unit for Nanostructured Materials Systems

Keywords: polymeric foams, carbon nanotubes, halloysite nanotubes, mechanics of porous media, finite element modeling