

Αγγλική Περίληψη

Over the past 15 years, due to the progress of all devices and the technological revolution to the nanometer scale, it has generated a great deal of interest about the polymeric scaffolds in the research community. The fibers are found everywhere and with proper structure and modification they have remarkable properties. Some of their applications include drug delivery systems, tissue regeneration, reinforcing for synthetic materials and their application as antimicrobial surfaces. In fact, these are nanostructured polymer systems whose mechanical properties require careful study, as the viability of both the scaffold itself and the viability and function of the adherent cells depend on them. In view of the above, this thesis presents the study of nanomechanical properties and the surface morphology mainly of soft matter. Specifically, the purpose of this thesis was to study the mechanical properties of polymer systems with applications as drug delivery systems as well as those with applications as antimicrobial surface, and how the specific mechanical properties change with the addition of an agent such as drug or nanoparticles (NPs) ZnO respectively. For this purpose, the technique of Nanoindentation (NI) was chosen. In addition, the objectives of this diploma thesis were to determine (a) the minimum vertical load of single fiber deformation, (b) the adhesion force between the tip and the sample, and (c) the minimum lateral load detachment and / or generally deformation of individual fibers. Starting from the theoretical part, the first three chapters introduce nanotechnology and in particular nanostructured materials and simultaneously summarizes the polymers used as well as the techniques of Atomic Force Microscopy (AFM) and Nanoindentation (NI). Also, the fourth chapter introduces a bibliographic introduction of the mechanical properties of the polymeric materials and analyzes the theoretical mechanical analysis models with which the analysis of the experimental results can be realized. The study of the mechanical properties of polymeric systems for use as drug delivery systems, as it results from NanoIndentation (NI) experiments, is presented in detail in the fifth chapter. In particular, the mechanical properties of the polycaprolactone scaffold (PCL) are being studied when drug is added, in particular Curcumin and / or Vancomycin. In addition, the mechanical properties of cellulose acetate (Cellulose Acetate, CA) fibers were studied and the manner were modified when Dexamethasone is added. Furthermore, polymeric systems with applications as antimicrobial surfaces in terms of their mechanical properties are studied. In particular, the results of the mechanical properties as measured by the Nano Indenter layout for the PCL scaffold and their variations when added to

the PCL, NPs ZnO fibers are presented. For the same polymer systems, the results from their mechanical deformation study with the AFM technique are also presented.