FA5-MS06-P01

X-ray Scattering and Diffraction Studies on Spider Silk Cocoons. Elif Hilal Soylu[a], Semra Ide[b], Tuncay Turkes[c], Neslihan Kocatepe[d], Orhan Mergen[d], Omer Celik[e]. [a]*Karadeniz Technical University, Faculty of Science & Literature, Department of Physics, Trabzon -Turkey.* [b]*Hacettepe University, Fac. of Engineering, Dept. of Physics Eng. 06800 Beytepe-Ankara, Turkey.* [c]*Nigde University, Faculty of Science, Department of Biology, Nigde-Turkey.* [d]*Hacettepe University, Faculty of Science, Department of Biology, 06800 Beytepe-Ankara, Turkey.* [e]*Harran University, Faculty of Science and Art, Dept. of Physics, 63300 Sanlıurfa, Turkey.*
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A spider can produce several types of silk (dragline, cocoon, etc.) which is a composite material with a hierarchical structure. This structure includes beta-sheet, polypeptide chain network and silk fibril. If the design of these bio-based materials and the relationships between protein sequence and structure-property are understandable, this knowledge can be used in technological applications ranging from medical (micro-sutures, artificial ligaments, tendons, and drug delivery coatings) to military (body armor, light weight gear) to civilian (textiles) usages [1-3].
The purpose of this study is to characterize the structure of silk cocoon samples which have high crystalinity and valuable protein contents. X-ray powder diffraction and SWAXS (Small and Wide Angle X-ray Scattering) methods were used for the structural characterizations. ARANEIDAE (Simon, 1895) and GNAPHOSIDAE (Pocock, 1898) families have been especially studied because of their productive properties. The crystallite size range, crystallinity percentages, number of crystallites and the distances between crystallites (depending on the direction of fibrils) have been determined. The results have been systematically evaluated and recorded as database for our ongoing TBAG project [4].

[1] Jonathan A. Kluge, Olena Rabotyagova, Gary G. Leisk, David L. Kaplan May **2008**, *Trends in Biotechnology*, Volume 26, Issue 5, Pages 244-251, [2] Fritz Vollrath and David P. Knight, "Liquid Crystalline Spinning of Spider Silk", *Nature* Vol 410, pp. 541-548, 29 March **2001**, [3] F.Teule, W.A. Furin, A.R: Cooper, J.R. Duncan, R.V. Lewis, **2007**, *J. Matter. Sci*. 42, 8974-8985, [4] Studies on fauna of Araneidae and Gnaphosidae (Araneae) familia from The Black Sea region of Turkey and nano-structure of silk which product by them(107T017).

Keywords: SWAXS; XRD; spider silk cocoon

FA5-MS06-P02

Preperation and Characterization of Novel Wood Nanocomposites. Semra Ide[a], Elif Hilal Soylu[d], Didem Rodoplu[c], Seyda Kucukyildiz[a], Gokce Sen[a], Salih Aslan[b], Sadan Ozcan[a], Musa Mutlu Can[a]. [a]*Hacettepe University, Department of Physics Engineering/ 06800 Beytepe-Ankara-Turkey.* [b]*Hacettepe University, Division of Wood Products Industrial Engineering/ 06800 Beytepe-Ankara-Turkey.* [c]*Hacettepe University, Institu of Pure and Applied Sciences, Nanotechnology and Nanomedicine Division/ 06800 Beytepe-Ankara-Turkey.* [d]*Karadeniz Technical University, Faculty of Science & Literatur, Department of Physics/ 61080 Trabzon-Turkey.*
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Although wood is durable and strong as natural materials, it can be easily degraded under external effects in our daily life. Physical properties of wood materials such as transparent, flexible, wear-resistance, UV-protector, heat and cold insulator etc., have big importance in technological developments. Especially in nanotechnological investigations, their superior performance under different conditions and water repellent properties attracts much attention [1-5]. In this study, Small and Wide Angle X-ray Scattering (SAXS and WAXS) methods were used to characterize the natural structures of poplar (populus), hornbeam (carpinus), chesnut (castanea) and walnut (juglans) trees originally form Turkey forests and their micropowders of aspen heartwood and aspen sapwood parts. After first structural comparisons , their micropowder forms, metal oxide nanopowders (aluminium, cobalt, nickel oxide etc., size range ~ 10-20 nm) and kleiberit 303 (as PVAC base adhesive) were mixed and the new substances were typically stirred for 30 min-120 min to prepare cylindirical and planar shaped nanocomposite hardboards. As secondary part of the study, SWAXS measurements have been performed for wood nanocomposites to determine the shape and distributions of nanosized aggregation. Pair distance distributions and size distributions were obtained and compared to prepare homogenous samples. Beside of these studies, moisture contents, thickness swelling of the samples and mechanical properties (strain and stress) were also determined.
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Keywords: wood; nanocomposites; SWAXS

FA5-MS06-P03

Novel Bone Nanocomposites: Preperation, FTIR and SWAXS Analysis. Sevgi Bayari[b], Semra Ide[a], Elif Hilal Soylu[c], Didem Rodoplu[a], Tuna Vargı[a], Atila Yoldas[d]. [a]*Hacettepe University, Department of Physics Engineering-Institu of Pure and Applied Sciences, Nanotechnology and Nanomedicine Division 06800 Beytepe-Ankara, Turkey.* [b]*Hacettepe University, Department of Physics Education, 06800 Beytepe-*

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The structure of a natural bone has well oriented hydroxyapatite crystals and fibrous collagens. Although very different materials have been used for bone replacement and substitutes, mechanical and biological performances of these substances still are not very close to those of natural bones. Scientific researches about this subject have been going on with increasing interests [1].
The aim of this study is to prepare novel biocompatible bone nanocomposites to use in veterinary orthopedic surgery and bone tissue engineering as bone filling materials. Sprague Dawley / Wistar Rats and New Zealand White Rabbits' femur, tibia and calvairum bone samples were used after sterilization and autoclave application and turned into micropowder forms by using a grinder. Molecular structure of hydroxyapatite has been confirmed and controlled and then the crystallite sizes, crystallite morphologies and distributions in the micropowder contents were investigated by FTIR and SWAXS methods. Moreover, titanium and zirconium oxide nanopowders that can modify cell response and dental restorative Eco-Flow (Ivoclar Vivadent AG) were systematically mixed with micropowders and stirred for 20 minutes and then the prepared forms have been poured into a special matrix having four cells. Hardening of the samples was also completed by using visible light. FTIR and SWAXS measurements have been also carried out to characterize the shapes, sizes, distributions and molecular contents of the nanostructured aggregations. Mechanical testing of the samples was also carried out to compare mechanical properties of the composites including different bones and metallic nanopowders.

Authors thank Hacettepe Univ. Scientific Research Unit for the support in the project no: 06A602012

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Keywords: bone nanocomposites; FTIR; SWAXS; natural bones

FA5-MS06-P04

Structure Investigation of Individual GaAs Nanorods by X-ray Coherent Diffraction Imaging

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Semiconductor 1D nano structures are very promising for future manufacturing of semi-conductor devices such as different kind of diodes or devices for high speed electronics. Up to now the most common way to grow such so called nanorods is the vapor-liquid-solid method (VLS), Typically the NR grow onto 111 planes of zinc-blende structure compounds. Unfortunately in this method positions and size of nanorods are defined by the position and size of catalyst droplets. Therefore it is not possible to grow nanorods with uniform size and uniform contribution onto the substrate. An alternative to overcome this drawback is the growth of nanorods without the use of a catalyst onto a pre-patterned substrate. Here NR only grow on certain position and with nearly uniform size [1,2]. However, the MOVPE growth process is not well understood so far.

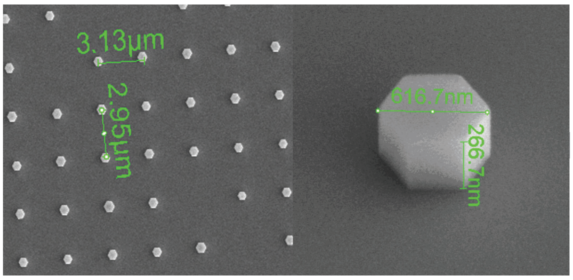

Fig 1. NR -STEM picture of single NR and array of NR's

The aim of this work was structural X-ray analysis [3] of single rods grown by MOVPE. To do this we have measured a sample with GaAs NR's grown on GaAs (111) B substrate with inter-rod distance of 3µm (Fig.1) grown at 750C^0 with III-V ratio of 80 using SiN_x layer. The sample was inspected using the microfocus setups at ID1 of ESRF. Using Fresnel Zone Plates the spot size of x-ray beam was reduced to 200x 600nm which is small enough to select a single nanorod with diameter of 600nm.

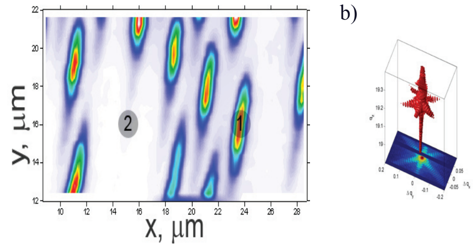

Fig. 2. Experemental RSM: a) Scaning area; b3D image of single rod in RS

Using the 111 position of GaAs nanorod which was slightly mismatch with respect to the substrate we recorded an intensity map of the whole nanorods array. At the position of a single rod (Fig. 2a) we were able to record a 3D image using Coherent Diffraction Imaging (Fig. 2b). Cut in (q_x,q_y) plane shows the picture with CTR in six directions corresponding to side planes of single nanorod with regular hexagon shape (Fig.3).