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New ceramic material improves properties of hydroxyapatite nanoparticles

(*Nanowerk News*) Researchers proposed a simple and cheap method to produce hydroxyapatite nanoparticles and improve its mechanical properties ("A novel hydroxyapatite – Hardystonite nanocomposite ceramic").

Hardystonite was used in this method as a new ceramic material to increase the mechanical properties of hydroxyapatite and to conserve the biocompatibility of the final product.

Hydroxyapatite is a very commonly-used material in tissue engineering. This material has great compatibility with human body. However, its weak mechanical properties create some problems in its applications in bioengineering. Therefore, it is necessary to use other materials to improve the mechanical properties of hydroxyapatite.

In this research, natural hydroxyapatite nanoparticles were produced through a simple and cheap process by using cow bone as raw material. Then, hardystonite (HT) ceramic was injected into hydroxyapatite through mechanical activation method. Significant increase in strength, density and intensity of the produced nanocomposite results in a decrease in the solubility of calcium ions, and it prevents the excess increase of pH value in the blood.

Although many researchers have so far tried to improve the mechanical properties of hydroxyapatite, results of this research confirm the advantages of the nanocomposite produced in this research over other products. Increase in corrosion resistance and excellent chemical stability are among other advantages of the product.

Chemical stability increases noticeably in the nanocomposite due to the high intensity of the product. In addition, corrosion resistance increases too. This characteristic results in negligible solubility of the produced nanocomposite in biological environment.

Source: *INIC*

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ASYLUM RESEARCH
Atomic Force Microscopes

NanomechPro Toolkit
DATA SHEET 43

The NanomechPro™ Toolkit: Accurate Tools for Measuring Nanoscale Mechanical Properties for Diverse Materials

Understanding nanoscale mechanical properties is of fundamental importance for evaluating the behavior and performance of a wide variety of industrially, biologically and structurally important materials. An Atomic Force Microscope (AFM) tip interacting with a sample experiences forces originating from many different sources – elasticity, viscosity, adhesion, van der Waals – to name a few. Hence, it has become increasingly clear that reliable and accurate materials properties measurements require looking at your sample in more than one way. Single techniques are simply insufficient for accurately and rigorously revealing sample properties and can often yield misleading and even inaccurate results and conclusions.

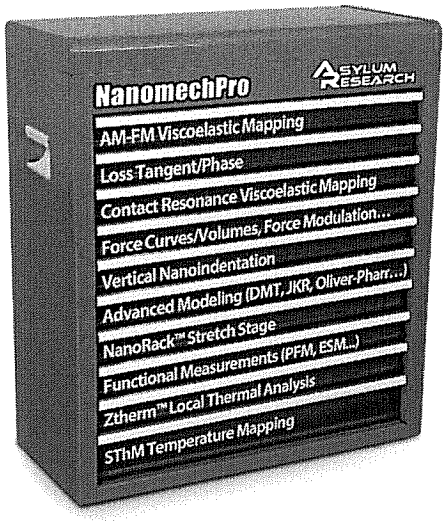


Figure 1: The NanomechPro Toolkit comprises a suite of accurate tools for measuring the nanoscale mechanical properties of diverse materials. The various tools are complementary – each technique probes and records different responses of your samples.

The NanomechPro™ toolkit (Figure 1) for Asylum's Cypher™ and MFP-3D™ AFMs provides a suite of tools to meet the requirements of the nanomechanics researcher and is both impressively powerful and rapidly expanding. The various tools are complementary – each technique probes and records different responses of your samples – and often can be used simultaneously (e.g. Figures 2a - d). Additionally, with the Cypher AFM, many of these new techniques can be combined with small, fast, low noise cantilevers, enabling measurements at noise levels and speeds previously impossible.

Combined Loss Tangent and AM-FM Viscoelastic Mapping

Amplitude-modulated (AM) atomic force microscopy, also known as tapping mode or AC mode, is a proven, reliable and gentle imaging method with widespread applications. Previously, the contrast in tapping mode has been difficult to quantify. However, in this work we introduce two new techniques that allow unambiguous interpretation of material properties in tapping mode: AM-FM Viscoelastic Mapping (AM-FM) and Loss Tangent. Because these measurements are made simultaneously, there is a built-in check for self-consistency in the measurements. The new AM-FM imaging technique combines the features and benefits of normal tapping mode with the quantitative, high sensitivity of Frequency Modulation (FM) mode. Both Loss Tangent and AM-FM imaging can be performed simultaneously at high data acquisition rates. These techniques are exclusively available from Asylum Research, US patents 8,024,963, 7,937,991, 7,603,891, 7,921,466 and 7,958,563 with others pending.