

Recent progress in the use of Atomic Force Microscopy (AFM) techniques in biomedical applications

Ayesha Siddiqua, MD
Graduate Student
Arkansas State University
Jonesboro, AR 72467
siddiqua438@yahoo.com

Zahid Hossain, Ph.D, P.E.
Associate Professor of Civil Engineering
Arkansas State University
Jonesboro, AR 72467
mhossain@astate.edu

Ahad Ali, Ph.D.
A. Leon Linton Department of Mechanical Engineering
Lawrence Technological University
Southfield, MI 48075, USA
aali@ltu.edu

Abstract

In recent years, the atomic force microscopy (AFM)-based techniques have gained popularity in biomedical applications. Different modes such as contact, no-contact, and nanoindentation of an AFM can be very useful to understand nanoscale phenomena of cancerous cells. In particular, morphological and phase contrast images, and nanomechanical data obtained from an AFM can provide a better understanding on the nature, strength and progression these cells, and treatment measures can be adopted based on the diagnoses results. This paper provides an overview of different AFM-based scanning modes and its prospects in biomedical applications based on an extensive review of existing literature available in public domain. Outcomes of this study are expected to be beneficial for researchers and medical professionals in getting familiarized with the AFM technologies and their applications as novel diagnostic tools.

Keywords

Atomic force microscope, Nanoindentation, Morphology, Biomedical, Cell culture

Biographies

Ayesha Siddiqua is a graduate student at Arkansas State University. She earned her Bachelor of Medicine and Bachelor of Surgery (MBBS) from the University of Dhaka. She has been working as a Research Associate with multiple faculty members at the Arkansas Bioscience Institute (ABI) for last several months. Her primary research focus has been cell culture, microscopy and imaging for understanding growth of cancer cells. She is an Educational Commission for Foreign Medical Graduates (ECFMG) certified medical doctor in the United States.

Zahid Hossain is an Associate Professor of Civil Engineering at Arkansas State University. He has over ten years experience in teaching and scholastic activities with an emphasis in the development and characterization of sustainable materials for engineering applications through fundamental science approaches. Further, he has

conducted applied research in developing novel concrete and asphalt materials using recycling and nano-science technologies. Prior to joining A-State, Dr. Hossain worked as a Post-doctoral Research Associate at the University of Oklahoma (OU). Dr. Hossain has authored 55 peer-reviewed journal articles, and 50 referred conference papers, and served in different capacities (member, reviewer, editor, etc.) of several academies, professional journals, and scientific boards. Dr. Hossain received multiple prestigious awards that included 2014 Ralph E. Powe Jr. Faculty Enhancement Award from Oak Ridge Associated Universities (ORAU), 2013 Faculty Award for Scholarship from Arkansas State University (A-State), and 2012 University Transportation Center (UTC) Award from the US Department of Transportation (USDOT) for his outstanding contributions in transportation research, professional service and academic excellence. Dr. Hossain is Professional Engineering in the state of Arkansas.

Ahad Ali is an Associate Professor, and Director of Master of Engineering in Manufacturing Systems and Master of Science in Industrial Engineering in the A. Leon Linton Department of Mechanical Engineering at the Lawrence Technological University, Michigan, USA. He earned B.S. in Mechanical Engineering from Khulna University of Engineering and Technology, Bangladesh, Masters in Systems and Engineering Management from Nanyang Technological University, Singapore and PhD in Industrial Engineering from University of Wisconsin-Milwaukee. He has published journal and conference papers. Dr Ali has completed research projects with Chrysler, Ford, New Center Stamping, Whelan Co., Progressive Metal Manufacturing Company, Whitlam Label Company, DTE Energy, Delphi Automotive System, GE Medical Systems, Harley-Davidson Motor Company, International Truck and Engine Corporation (ITEC), National/Panasonic Electronics, and Rockwell Automation. His research interests include manufacturing, simulation, optimization, reliability, scheduling, manufacturing, and lean. He is member of IIE, INFORMS, SME and IEEE.