Agilent AFM/Raman System

Combines Atomic Force Microscopy and Raman Spectroscopy

Data Sheet

The Agilent AFM/Raman System.

Features and Benefits

- New, fully integrated, high-precision AFM/Raman system
- High performance Raman system for material ID and analysis
- Advanced software enables one-click operation
- Simplified alignment of the Raman laser on the AFM tip
- Tip Enhanced Raman Spectroscopy (TERS) ready system for transparent samples
- Incubator perfusion cell sample plate facilitates dynamic studies in liquids and gases
- Enhanced PicoView software flexibility for plug-ins and scripting

Applications

- AFM/Raman co-localization
- TERS
- AFM force-volume spectroscopy
- Life science and materials science

Overview

This new system seamlessly integrates the Agilent 6000ILM AFM (atomic force microscope) and a HORIBA XploRA INV (inverted Raman microscope), letting researchers go beyond the optical diffraction limit to achieve nanoscale resolution imaging as they perform Raman spectroscopy.

System capabilities include AFM/Raman co-localization, tip-enhanced Raman spectroscopy, and AFM force-volume spectroscopy. The system is ideal for conducting advanced life science research, including studies of cell membranes, the surface structure of cells, single DNA/RNA strands, individual proteins, single molecules, and biopolymers. It is also ideal for investigating novel materials (e.g., graphene).

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AFM/Raman co-localization can be performed simultaneously using PicoView to control the Raman Spectroscopy system. Raman mapping is achieved by acquiring a complete Raman spectrum at each pixel of a 2D image to create a detailed chemical image of the sample. This image is generated by plotting the peak intensity (material concentration), peak position (molecular structure or material stress), or peak width (crystallinity). The system precisely overlays the detailed chemical image with a 3D AFM topography image.

An XY piezo stage is used for both Raman and AFM measurements. The 6000ILM AFM provides a wide range of direct sample property measurement (e.g. elasticity) which can be correlated via Raman with chemical composition. Tip-enhanced Raman spectroscopy (TERS) is possible by focusing the Raman laser at the tip of a special AFM probe leading to field enhancement of the laser/sample interaction and thus yielding higher Raman signals as well as increased spatial resolution.

An extensive range of AFM force-volume spectroscopy capabilities is also provided. Results are fast and reliable. Researchers can use their own algorithms and plug-ins, select their own data points on-the-fly, acquire force-curve measurements on any data point, and change experimental parameters in real time.

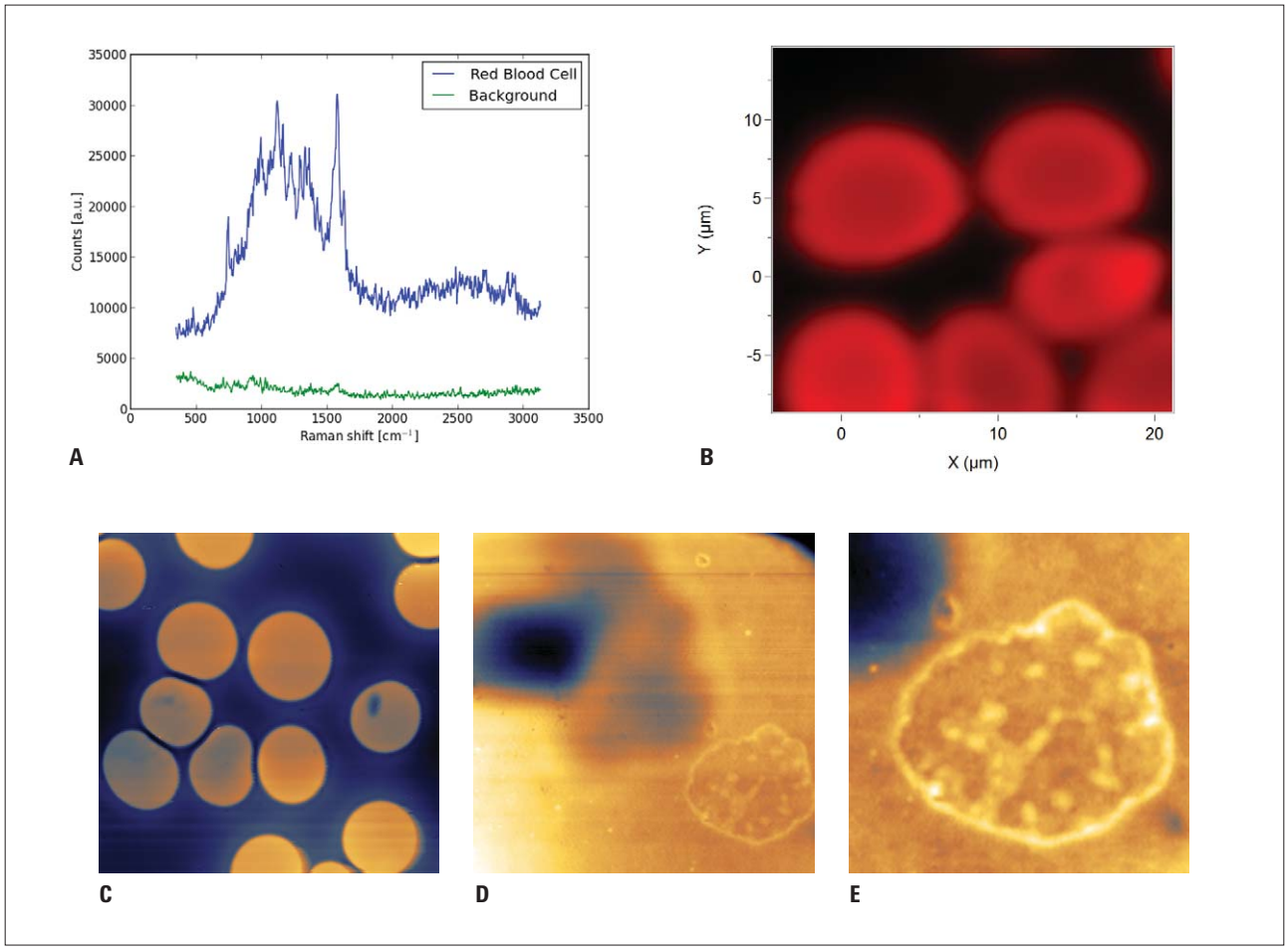

Figure 1. AFM co-localization and Raman mapping of red blood cells. (A) Raman spectrum. (B) Raman map of peak at 739 cm^{-1}. (C) AFM topography image. (D, E) High resolution AFM topography of the middle cell on the left side in image (B).

Advantages

The 6000ILM AFM utilizes a computer-controlled laser with automated photodetector alignment. A high-stability, low-noise motorized stage directs the movement of the sample beneath the AFM tip for measurement. Easy-to-use PicoView software provides impressive built-in functionality, such as point-and-shoot AFM imaging based on an optical image.

Additional advantages include unrivaled in-liquid AFM imaging via Agilent's patented MAC Mode, the availability of an incubator perfusion cell sample plate to facilitate dynamic studies in liquids and gases, and a top-view video optics package that offers the ability to see opaque samples while scanning.

The XploRA INV from HORIBA combines the exclusive automation features and small footprint of the standard XploRA Raman microscope with the unique sampling capabilities of an inverted microscope, especially important for demanding biological applications.

PicoView plug-in and scripting flexibility further expand the usefulness of the fully integrated AFM/Raman system.

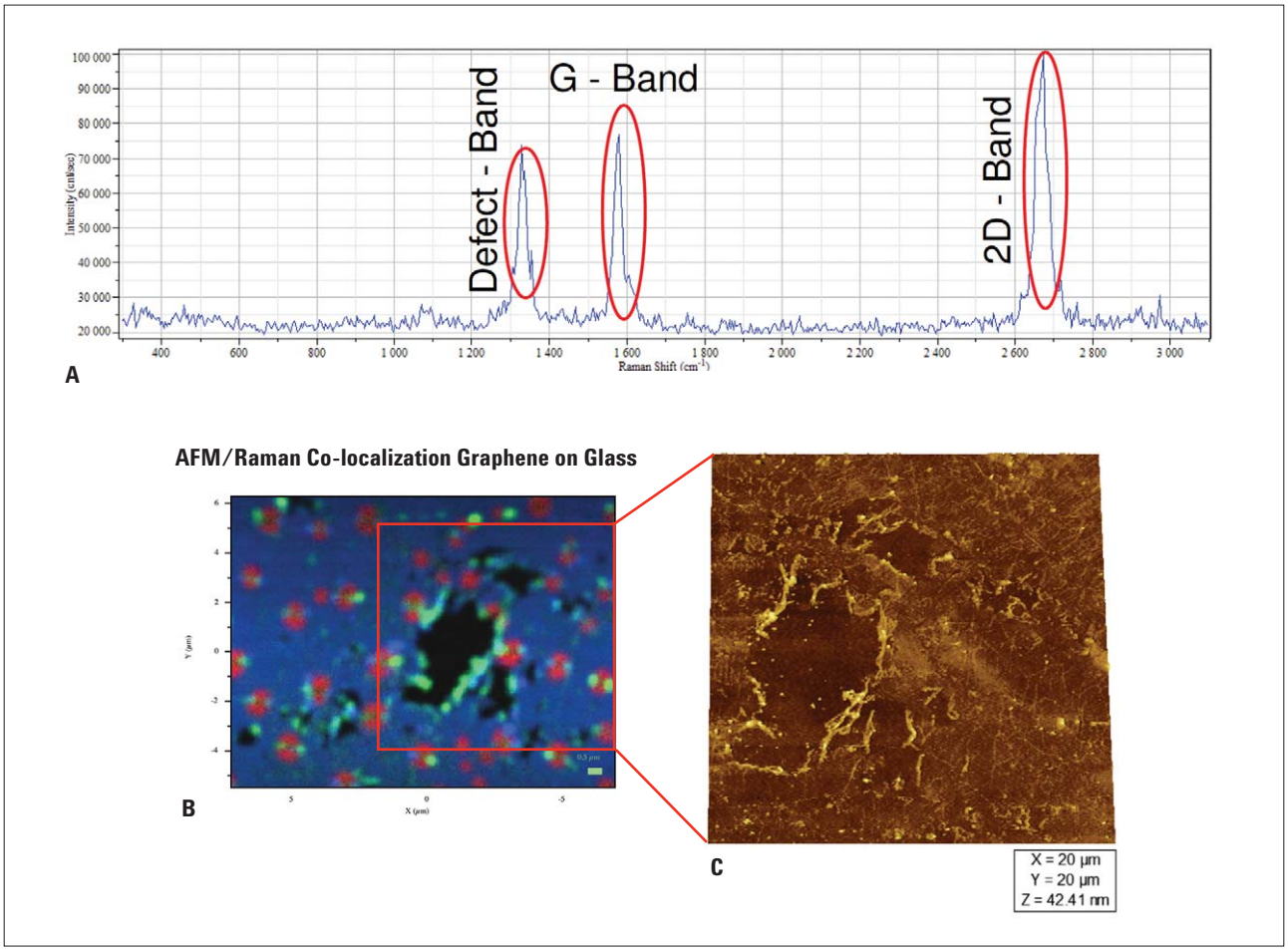

Figure 2. (A) Raman spectrum: G-band shows visible in graphite and graphene. 2D-band: only visible in graphene. Defect band: visible at the edges of graphene flakes. (B) Raman map: 2D, G and defect band overlaid. (C) AFM: 3D topography.

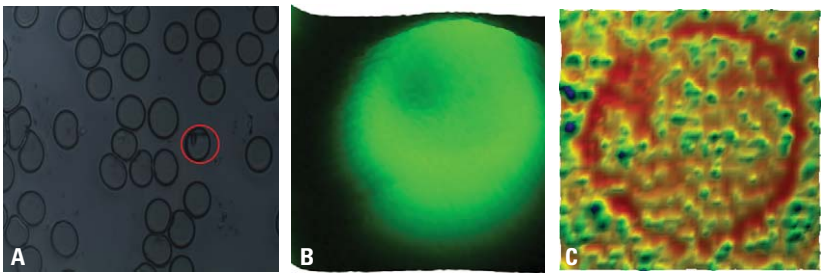

Figure 3. Simultaneous elasticity and Raman mapping of red blood cells. (A) Optical image of red blood cells; cell marked with red circle used for Raman mapping and elasticity. (B) Raman map. (C) AFM elasticity image.

Agilent 6000 ILM System Specifications

AFM Scanner	
X-Y (Closed Loop) Scan Range	100 µm x 100 µm
Z (Closed Loop) Scan Range	30 µm
Scanner Noise	0.3 nm (X–Y) 0.1 nm (Z)
Scanner Laser	Infared (980 nm)
Supported Microscopes	
Nikon	Ti-2000 Eclipse Series
Stages	
Stage Travel	4 mm x 6 mm
Motorized Stage Accuracy	±2.5 µm
System Noise	
	< 0.25 nm RMS (Air)
	< 0.25 nm RMS (Fluid)
Available Sample Plates	
Cover Slip	
Size	22 – 30 mm dia
Thickness	>170 µm
Microscope Slide	
Size	1" x 3" (25 mm x 75 mm)
Petri Dish	
Size	35 mm x 10 mm or 50 mm x 9 mm Plastic or plastic with glass bottom

For full 6000 ILM specifications please see 6000 ILM data sheet.

HORIBA XploRA

visit: http://www.horiba.com/us/en/scientific/products/raman-spectroscopy/raman-spectrometers/raman-microscopes/details/xplora-tm-124/

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