

# RIMA™

## HYPERSPSCTRAL MICROSCOPE

### MEGAPIXEL IMAGES IN MINUTES!



RIMA is a hyperspectral global microscope delivering spectral and spatial information. This system rapidly provides Raman maps over large megapixel-scale fields of view. Based on high throughput global-imaging filters, RIMA is faster and more efficient than standard point-by-point or line-scan based systems.



TECHNICAL SPECIFICATIONS		
Excitation wavelength	532 nm or 660 nm	785 nm
Spectral range	190 - 4000 $\text{cm}^{-1}$	190 - 2700 $\text{cm}^{-1}$
Spectral resolution (FWHM)	< 7 $\text{cm}^{-1}$	
Spectral channels	Continuously tunable	
Spatial resolution	Sub-micron - limited by the microscope objective NA	
Camera	Back-illuminated CCD	Back-illuminated deep-depletion CCD
Microscope	Upright or inverted	
Wavelength absolute accuracy	1 $\text{cm}^{-1}$	
Maximum scanning speed	150 ms per wavenumber	
X, Y Travel range	76 mm x 52 mm (with a manual stage)	
Z Stage resolution	100 nm	
Video mode	Megapixel camera for sample visualization	
Preprocessing	Spatial filtering, statistical tools, spectrum extraction, data normalization, spectral calibration	
Hyperspectral data format	HDF5, FITS	
Software	PC (Windows10 - 64-bits) with PhySpec™ control and analysis software (computer included)	
Dimensions*	≈ 102 cm x 76 cm x 76 cm	
Weight	≈ 80 kg	
Power requirement	120 VAC / 12A / 60Hz 230 VAC / 12A / 50Hz	

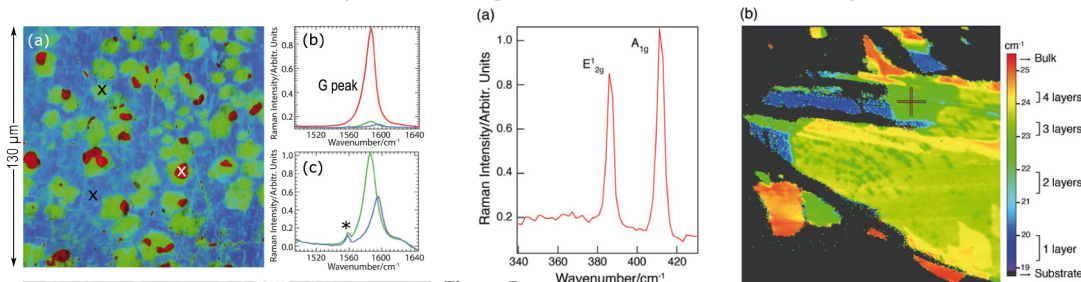
OPTIONS AND ACCESSORIES	
	Objectives magnification: 20X, 40X, 50X, 60X, 100X
	Spectral range extension: Anti-Stokes
	Motorized stage: 100 mm x 100 mm travel, 22 nm resolution
	Camera: EMCCD
	<i>*Optical table with passive anti-vibration isolation recommended: 900 x 1800 x 60 mm (36 x 72 x 2.4 inches) or 900 x 900 x 60 mm (36 x 36 x 2.4 inches) next to 900 x 900 mm (36 x 36 inches) standard table</i>

#### RIMA APPLICATIONS OVERVIEW:

- » Perform low-dimensional material analyses like graphene and carbon nanotubes.
- » Monitor and analyze biological tissues non-invasively.
- » Identify materials (plastic, metals) and characterize their structure (crystallinity, phase, chemical bond, strain, stress).

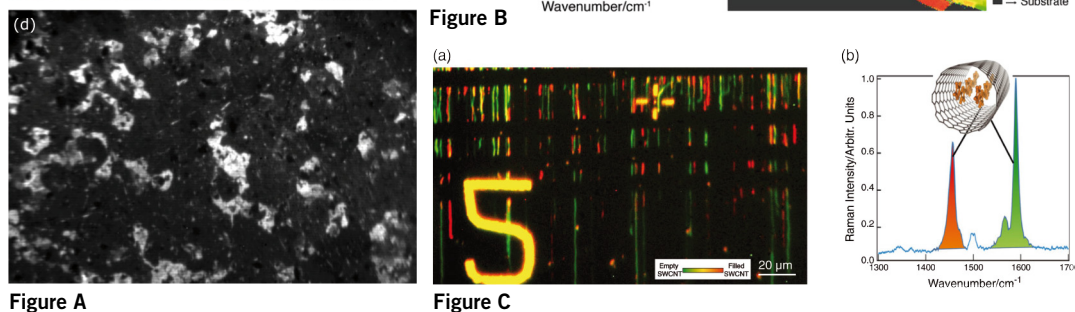
## Hyperspectral Raman imaging using Bragg tunable filters of graphene and other low dimensional materials

Etienne Gaufres, Stéphane Marcet, Vincent Aymong, Nathalie Y-Wa Tang, Alexandre Favron, Felix Thouin, Charlotte Allard, David Rioux, Nicolas Cottenye, Marc Verhaegen and Richard Martel. DOI: 10.1002/jrs.5298



Journal of  
**RAMAN  
SPECTROSCOPY**

**Figure A.** (a)  $130\ \mu\text{m} \times 130\ \mu\text{m}$  Raman mappings of the G peak intensity at  $\lambda = 532\ \text{nm}$  of graphene bilayer islands on a graphene monolayer. (b,c) Spectra of monolayer (blue) graphene and of nonresonant (green) and resonant (red) bilayer graphene islands from selected points in (a). The peak indicated by \* is an instrument artifact. (d) Raman image ( $70 \times 47\ \mu\text{m}^2$ ) of the G peak intensity of an artificial bilayer of graphene composed of two monolayers stacked on top of each other.



**Figure B.** (a) Raman spectrum at  $\lambda_{\text{exc}} = 532\ \text{nm}$  of few layers  $\text{MoS}_2$  extracted from a RIMA hyperspectral cube of the sample and corresponding to the area pointed by a cross in (b). (b) Color coded cartography ( $130\ \mu\text{m} \times 130\ \mu\text{m}$ ) of the layer composition of exfoliated  $\text{MoS}_2$  deposited on  $100\ \text{nm}\ \text{SiO}_2/\text{Si}$  substrate. The color code is obtained from the difference in peak positions between the  $A_{1g}$  and  $E_{12g}$  modes.

**Figure A**

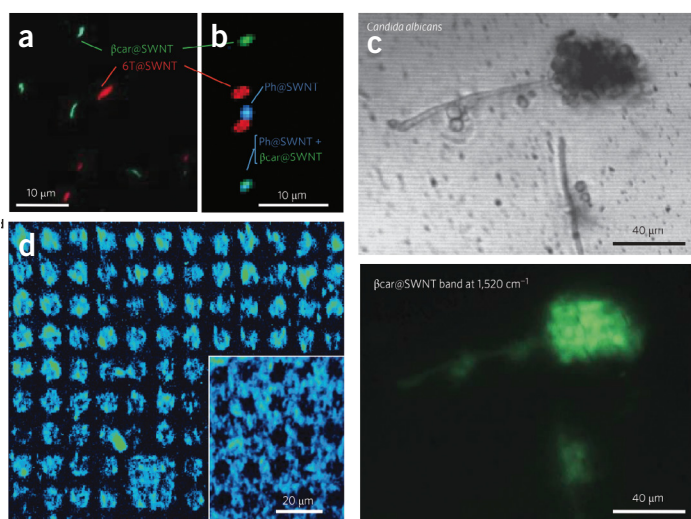
**Figure C.** (a)  $260 \times 260\ \mu\text{m}^2$  Raman mapping of 6T molecules encapsulated in carbon nanotubes (6T@SWCNTs). The image is a superposition of the maximum intensity of CNTs at  $1590\ \text{cm}^{-1}$  (green scale) and 6T at  $1450\ \text{cm}^{-1}$  (red scale) obtained after background subtraction. Empty CNTs in green can be distinguished from filled CNTs with 6T molecules in yellow or red, depending on the intensity. (b) A representative Raman spectrum of the sample showing the characteristic peaks of 6T around  $1460\ \text{cm}^{-1}$  and the G band of CNTs around  $1590\ \text{cm}^{-1}$ .

**Figure C**

## Giant Raman scattering from J-aggregated dyes inside carbon nanotubes for multispectral imaging

E. Gaufres, N. Y.-Wa Tang, F. Lapointe, J. Cabana, M.-A. Nadon, N. Cottenye, F. Raymond, T. Szkopek and R. Martel. DOI: 10.1038/NPHOTON.2013.309

nature  
photonics

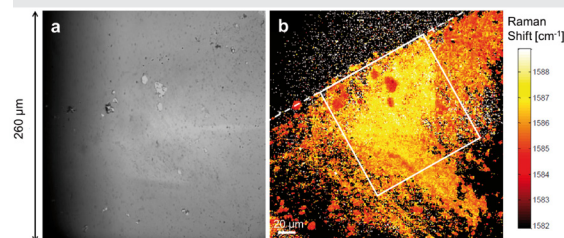


Raman multiplexing, protein recognition and tagged bacteria with dyes@SWNTs nanoprobes. (a) Raman hyperspectral image at  $\lambda = 532\ \text{nm}$  of isolated bundles of 6T@SWNTs (red) and Bcar@SWNTs (green) co-deposited at low coverage onto a  $\text{Si}/\text{SiO}_2$  substrate. (b) As in a, but using a mixture of 6T@SWNTs, Bcar@SWNT and Ph@SWNT (blue) nanoprobes on  $\text{Si}/\text{SiO}_2$ . (c) Top image: optical image of *Candida albicans* tagged with Bcar@PEG-SWNT. Bottom image: corresponding Raman image taken at  $532\ \text{nm}$  of the Bcar@f-SWNT mode centred at  $1,520\ \text{cm}^{-1}$ . (d) Raman image of the Bcar@PEG-biot-SWNT probe taken at  $532\ \text{nm}$  using the peak centred at  $1,520\ \text{cm}^{-1}$ . The Bcar@PEG-biot-SWNT probes selectively attached to immobilized streptavidin by microcontact printing in circular dot shapes (diameter,  $10\ \mu\text{m}$ ). Inset: results using the reverse pattern with surface streptavidin located surrounding the dots.

MDPI

## Electrostatic Deposition of Large-Surface Graphene

Charles Trudeau, Laura-Isabelle Dion-Bertrand, Sankha Mukherjee, Richard Marte and Sylvain G. Cloutier. DOI:10.3390/ma11010116



(a) White-light hyperspectral image with high field-of-view showing the edge of the deposition (dashed line). (b) Hyperspectral image of the full graphene deposition mapping the position of the highest intensity around the G peak ( $1500\text{--}1600\ \text{cm}^{-1}$ ). The white box represents  $130\ \mu\text{m} \times 130\ \mu\text{m}$ . Acquired using RIMATM - Photon etc.