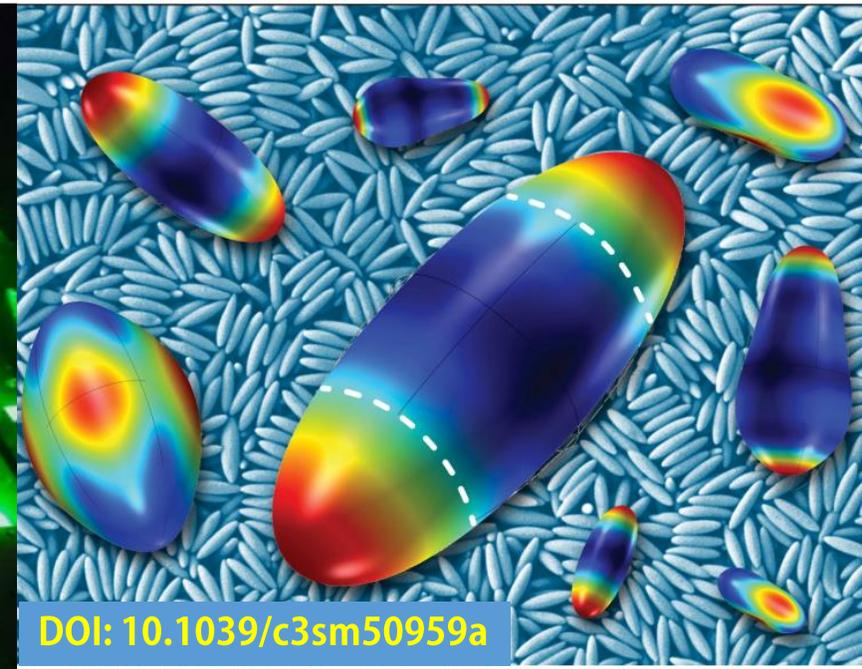
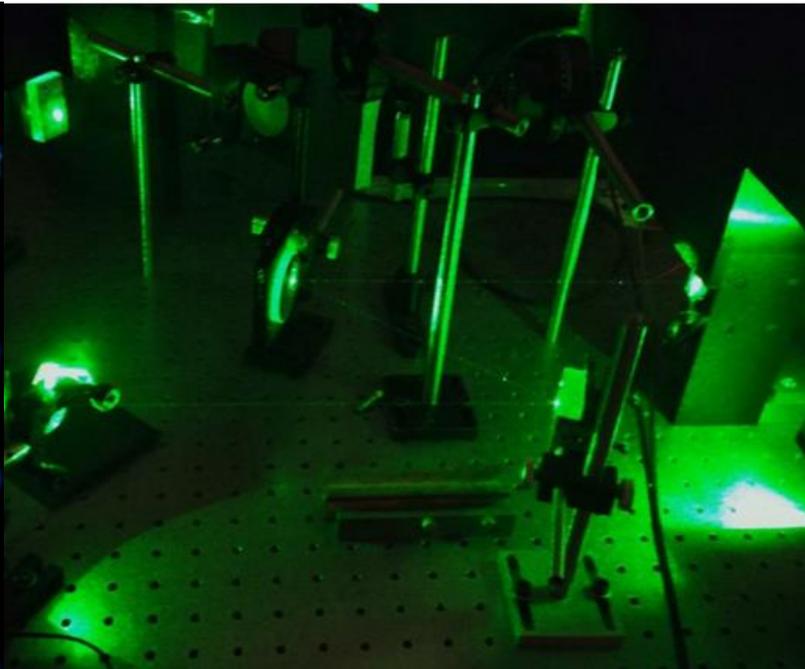
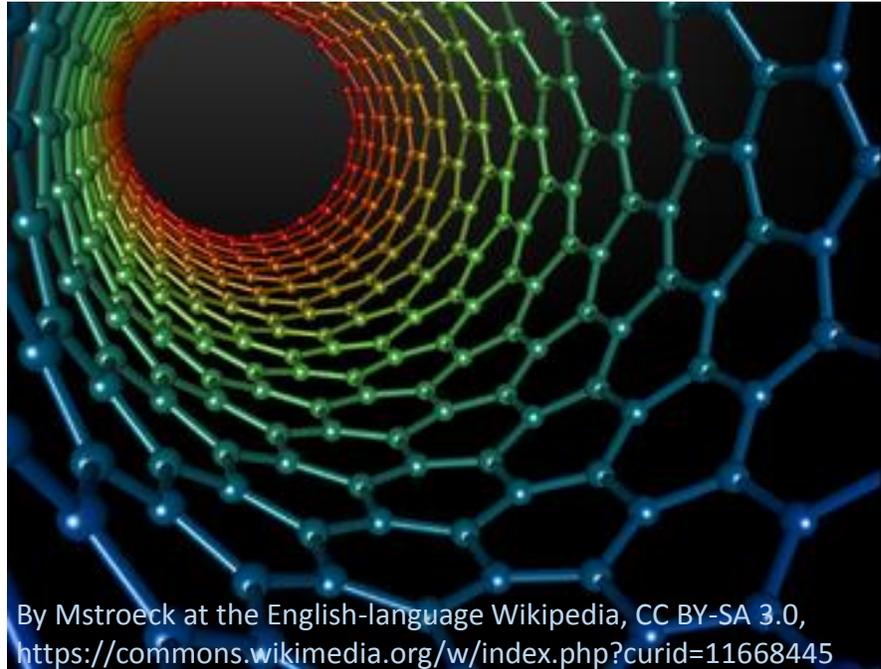


# Microscopia chimica e meccanica di materiali nanostrutturati

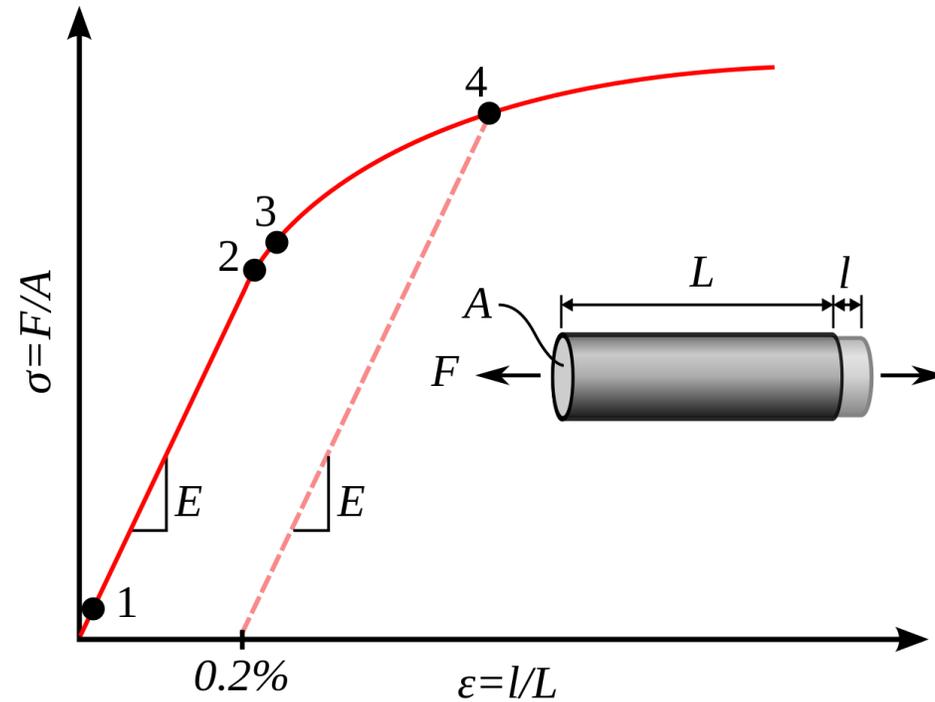
silvia.caponi@cnr.it  
CNR-IOM Perugia- ITALY



# Misura delle proprietà meccaniche

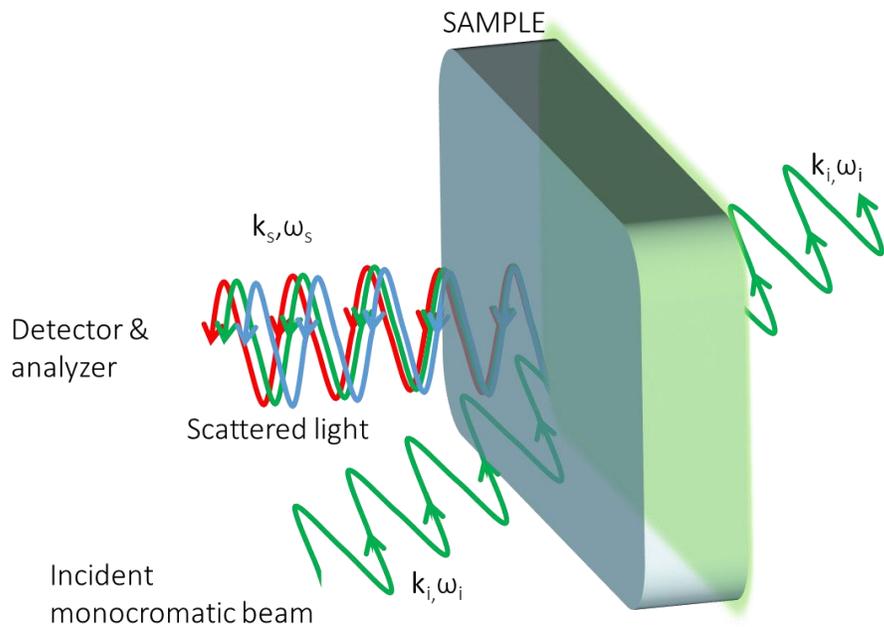


Definizione di Modulo elastico

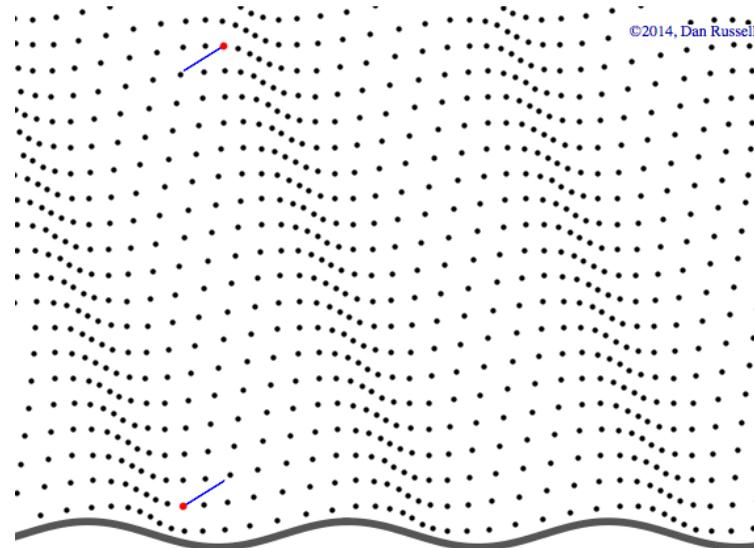


[https://it.wikipedia.org/wiki/Elasticit%C3%A0#/media/File:Metal\\_yield.svg](https://it.wikipedia.org/wiki/Elasticit%C3%A0#/media/File:Metal_yield.svg)

# Misura delle proprietà elastiche e chimiche ...usando un laser

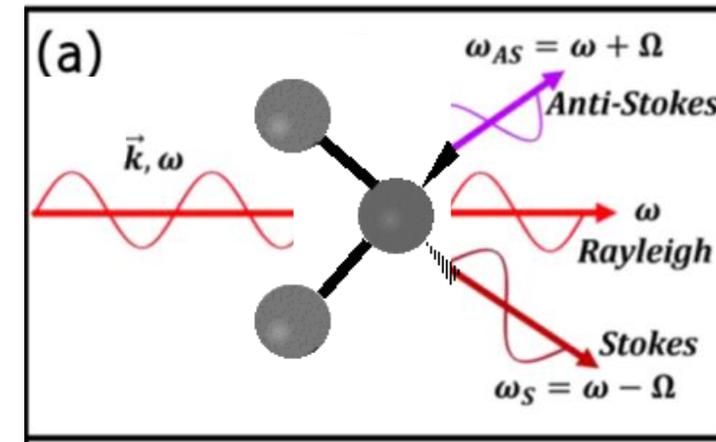


## Spettroscopia Brillouin



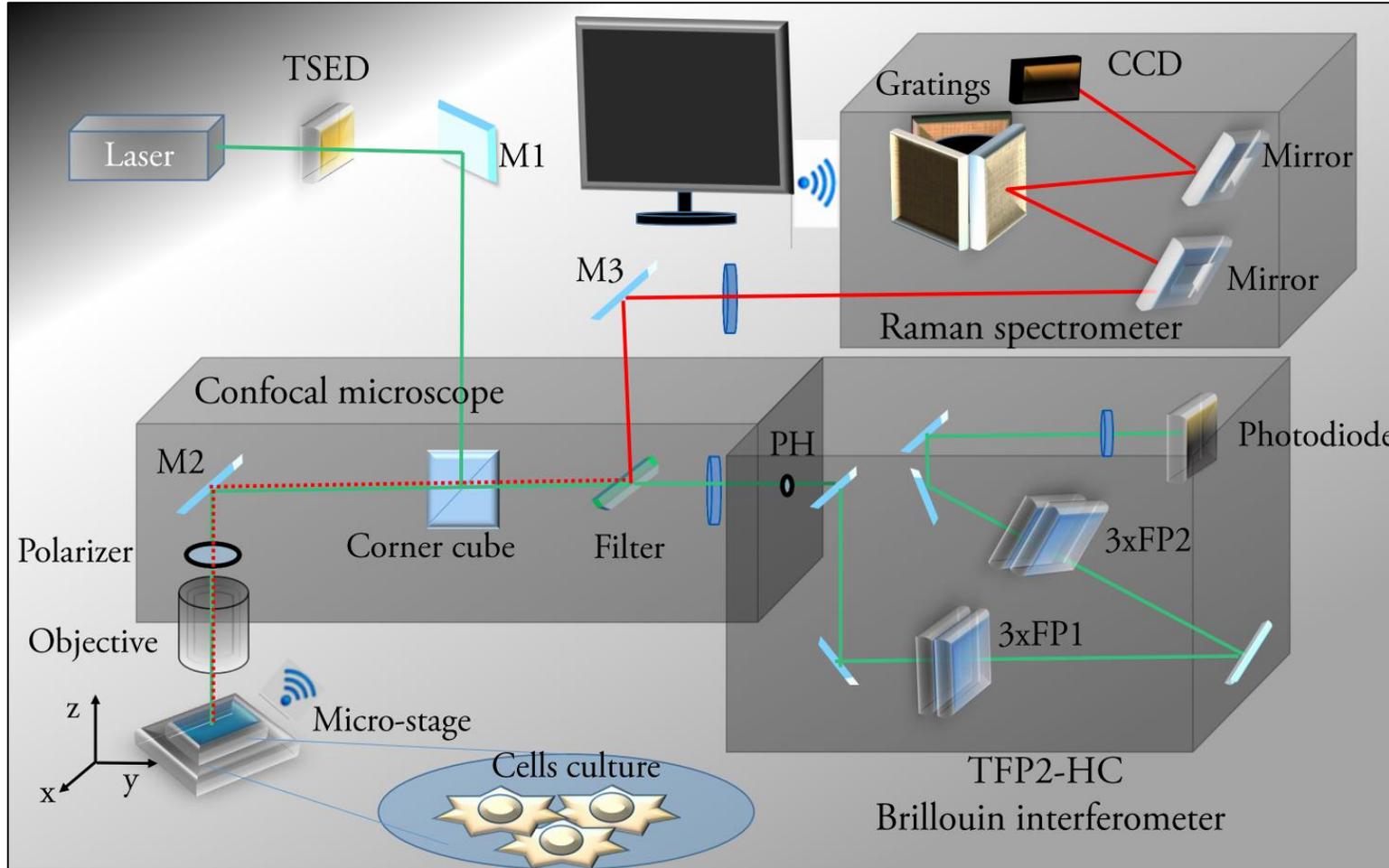
Animation courtesy of Dr. Dan Russell,  
Grad. Prog. Acoustics, Penn State

## Spettroscopia Raman





# Microscopia chimica e meccanica di materiali nanostrutturati



vibrational modes of molecules  
*Chemical properties - composition, structure*

thermally activated acoustic waves  
*Mechanical properties*

S. Mattana et al. Nature Light: Science & Applications **7**, 17139 (2018).

R. Mercatelli et al. Nature: Comms Biology **2** 117 (2019), F. Scarponi et al. PRX **7**, 031015 (2017)





# Microscopia chimica e meccanica di materiali nanostrutturati

in situ raster-scan of micro-structured composite material

two wool fibers embedded into epoxy film

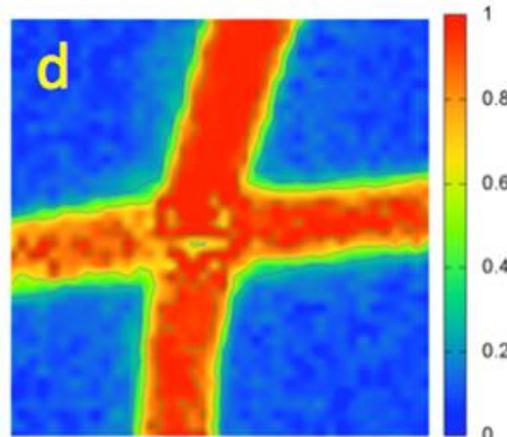
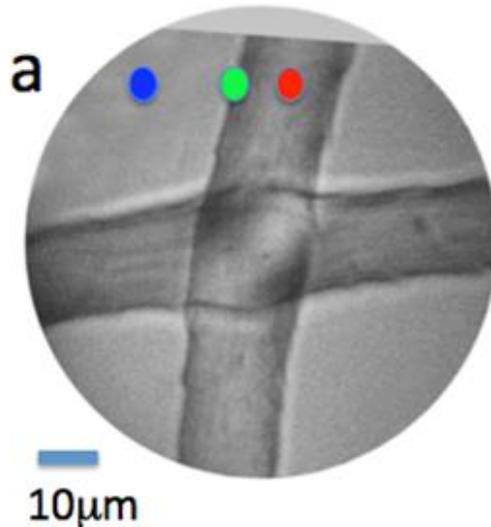
2 $\mu$ m step, 40  $\times$  40 points

10 s

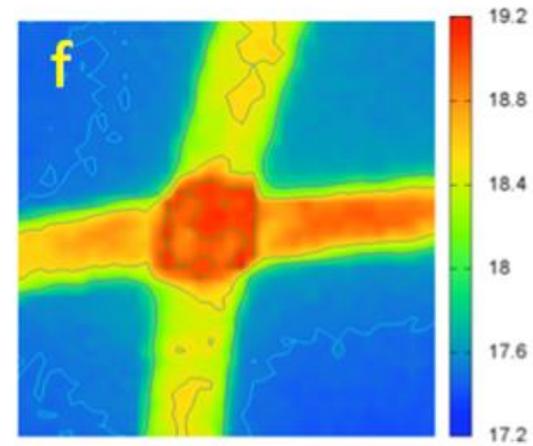
P=5mW

<https://doi.org/10.1364/BOE.10.001469>

Fioretto et al. Biomedical Optics Express (2019)



Chemical mapping

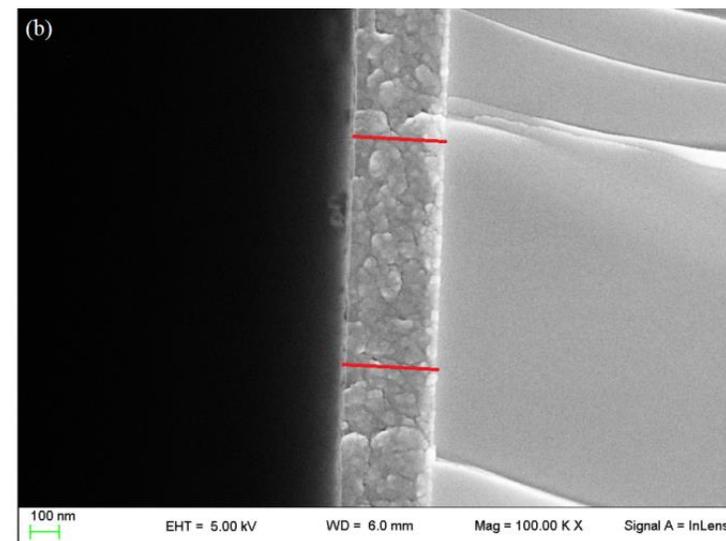
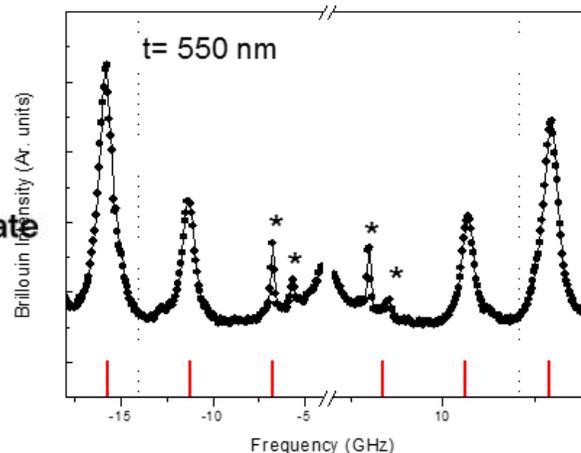
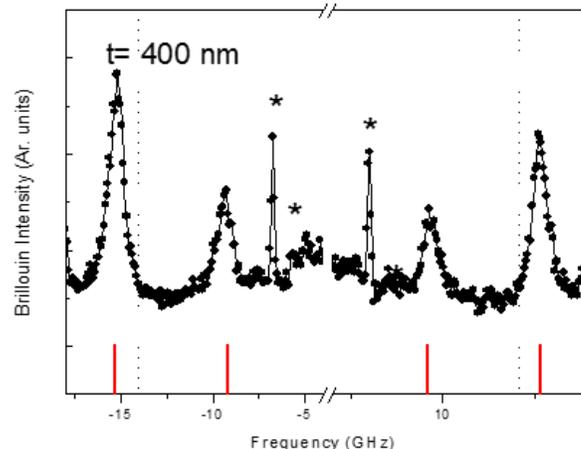
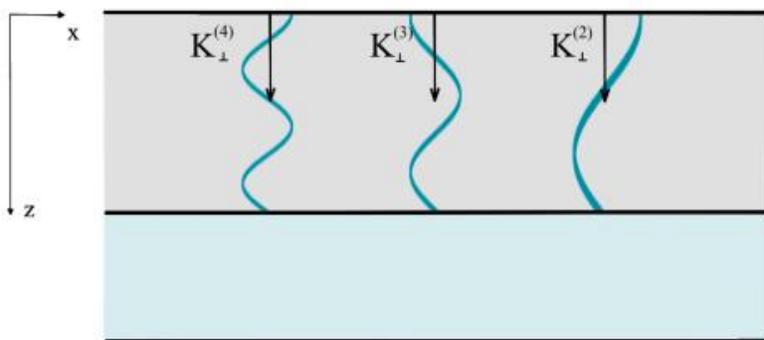


Mechanical mapping





# Microscopia chimica e meccanica di materiali nanostrutturati: FILM SOTTILI



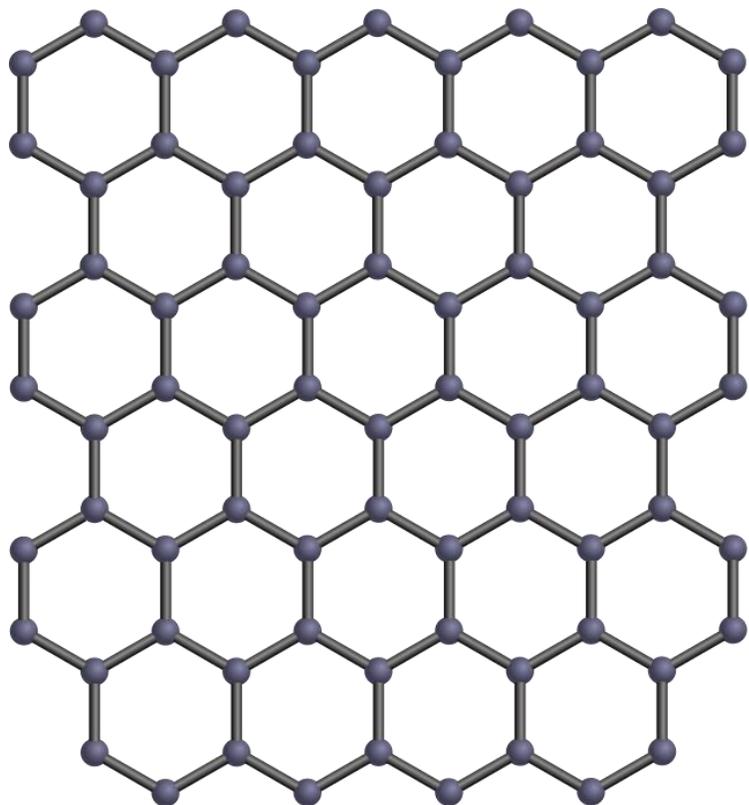
Film metallici, ceramici, polimerici con applicazioni in campo energetico/acustico:  
Isolamento termico/acustico, filtri ottici/acustici, coating protettivi





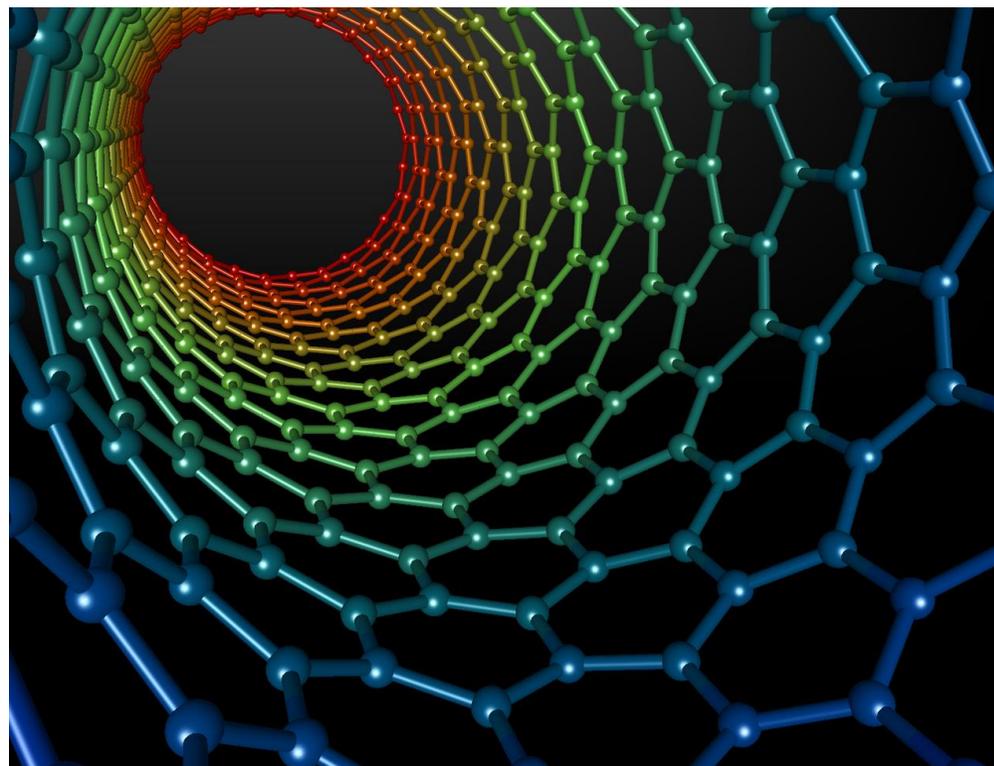
# Microscopia chimica e meccanica di materiali nanostrutturati: Nanostrutture di Carbonio

Grafene



<https://commons.wikimedia.org/wiki/File:Graphene.svg>

Nanotubi di carbonio



By Mstroeck at the English-language Wikipedia, CC BY-SA 3.0,  
<https://commons.wikimedia.org/w/index.php?curid=11668445>

vedi

Presentazione: Dr. Igor Neri

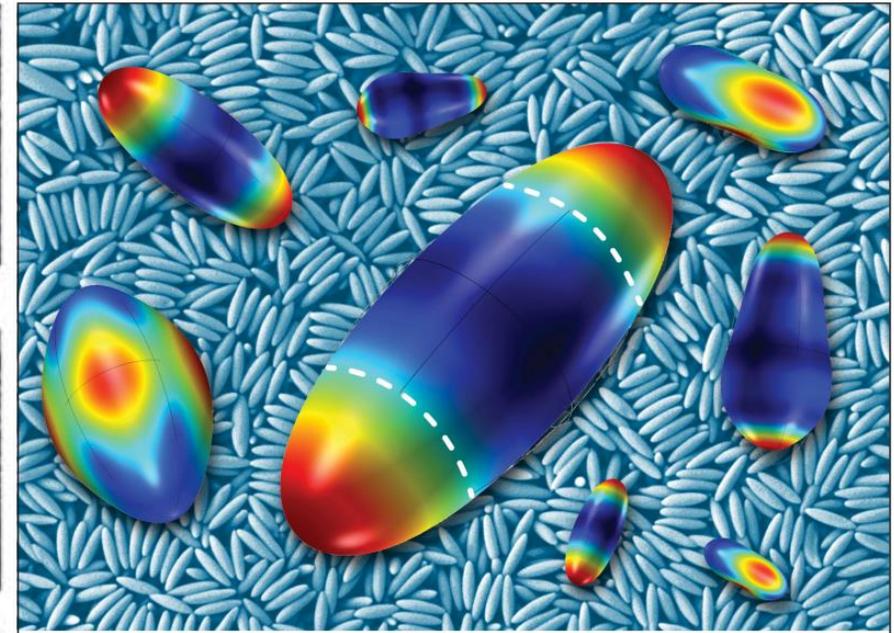
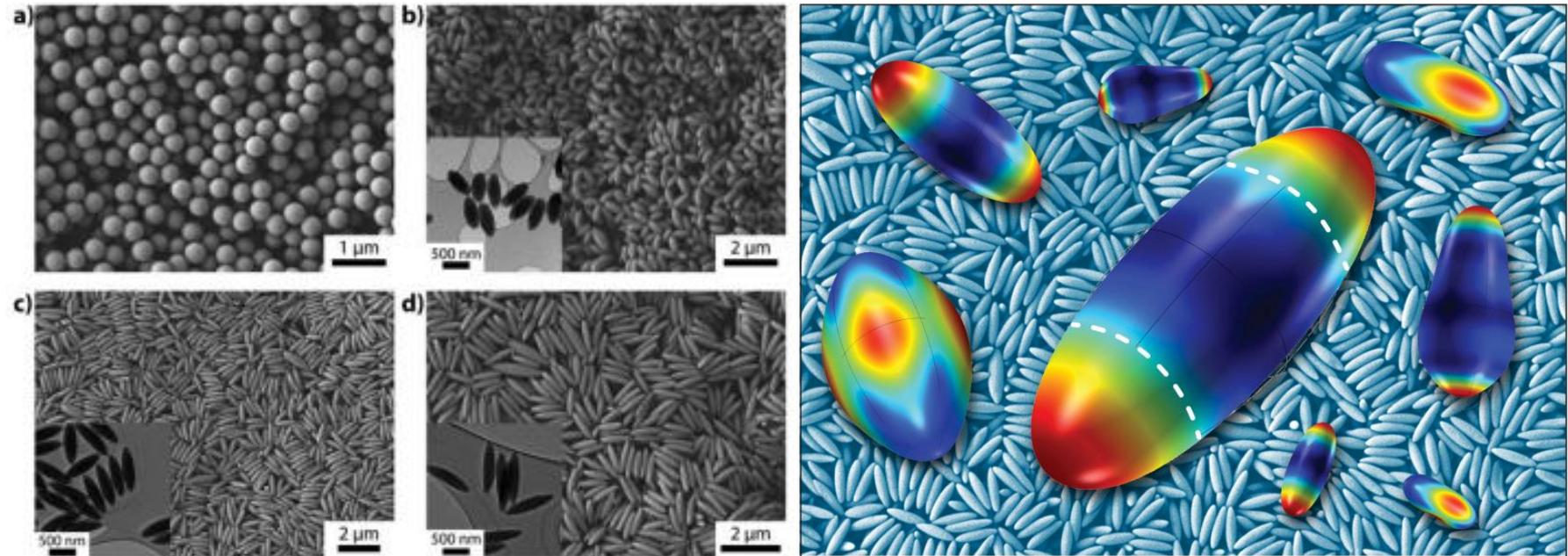
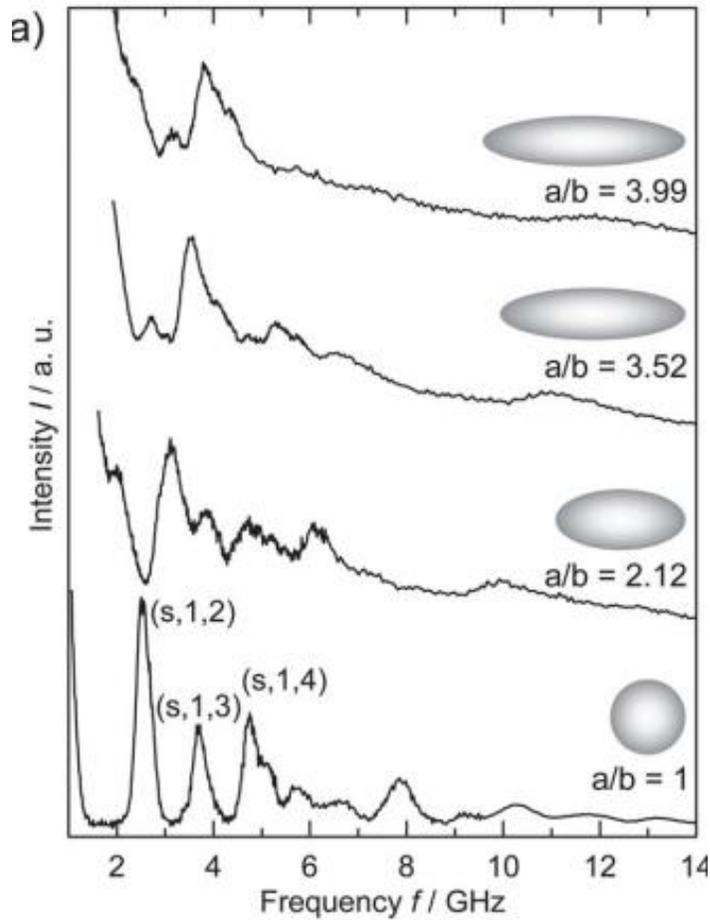
Presentazione: Prof. F. Cottone

Stesso congresso





# Microscopia chimica e meccanica di materiali nanostrutturati: NANO-PARTICELLE

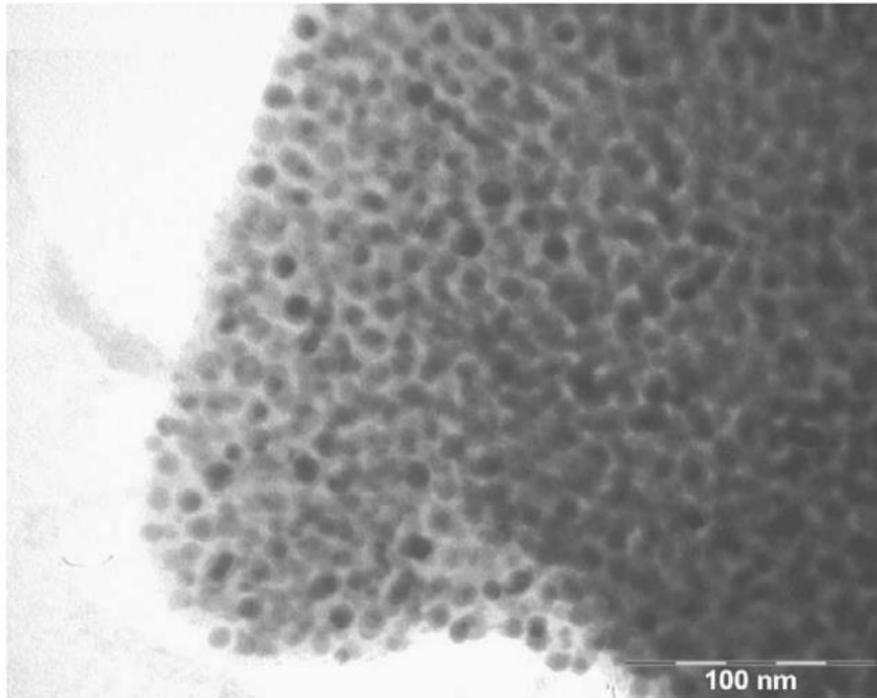


D. Schneider et al. *Soft Matter* (2013) 9, 9129  
DOI: [10.1039/c3sm50959a](https://doi.org/10.1039/c3sm50959a)

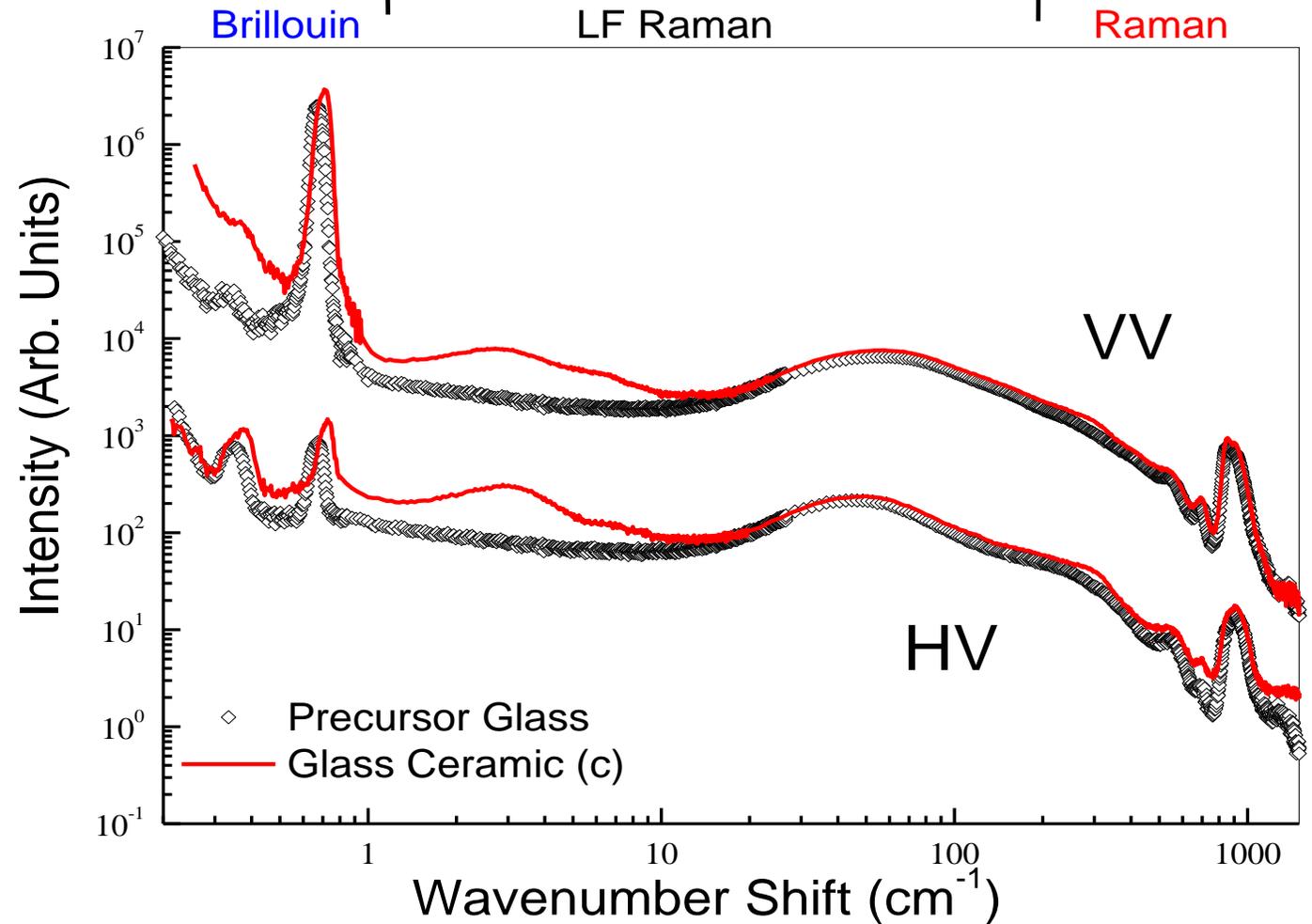




# Microscopia chimica e meccanica di materiali nanostrutturati: VETRI NANOSTRUTTURATI



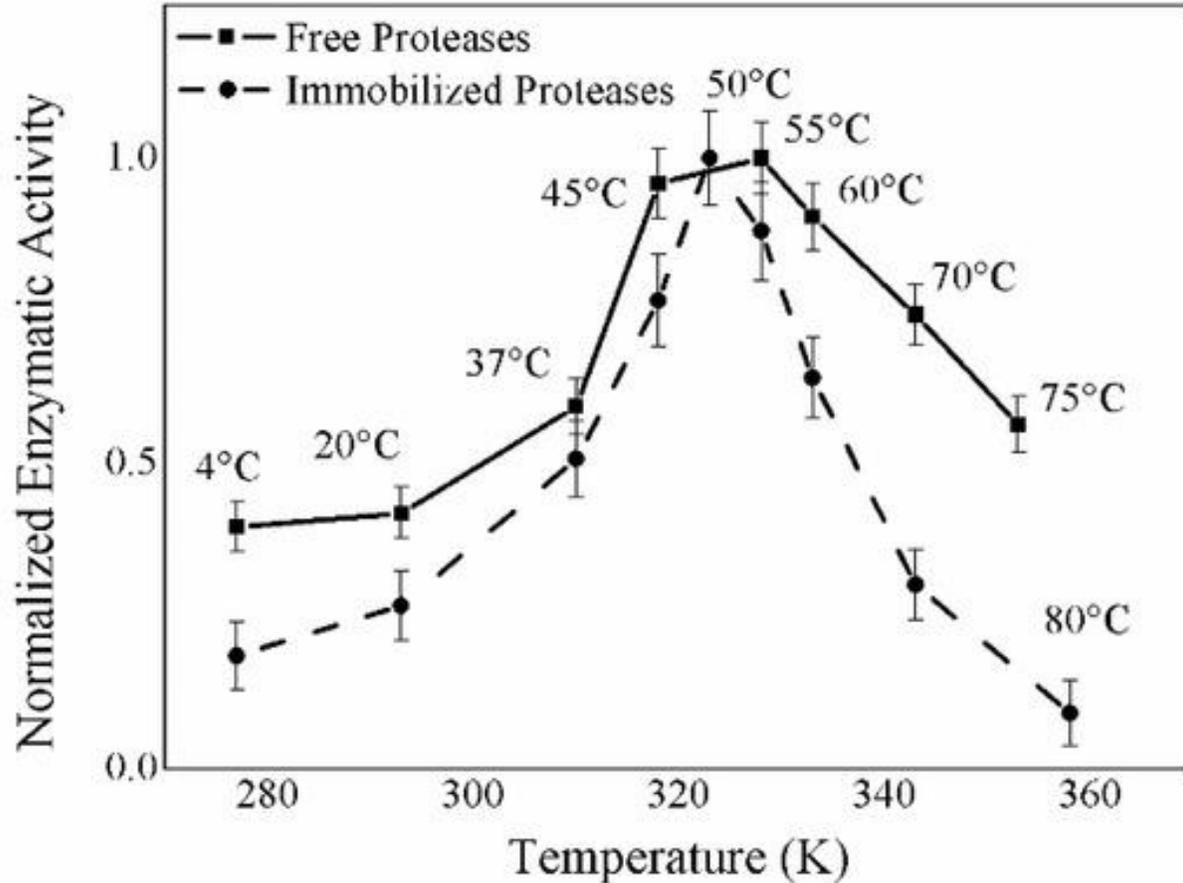
Mattarelli et al., *Optical Materials* 31 1362 (2009)



Mattarelli et al., *Optoelectronics Letters* 3, 188 (2007)



# Proteasi immobilizzate su matrici polimeriche per la degradazione delle biomasse



- Priority number 102019000025012

PROPRIETARI DEL BREVETTO  
CNR & Università degli Studi di Perugia

INVENTORI

C. Emiliani, E. Calzoni, A. Cesaretti, D. Fioretto, F. Cottone, A. Di Michele, S. Caponi, S. Tacchi

Calzoni, E. et al. Covalent Immobilization of Proteases on Polylactic Acid for Proteins Hydrolysis and Waste Biomass Protein Content Valorization. *Catalysts* 2021, 11, 167. <https://doi.org/10.3390/catal11020167>

<https://www.knowledge-share.eu/brevetto/proteasi-immobilizzate-su-matrici-polimeriche-per-la-degradazione-di-biomasse/>



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con la conoscenza  
cresciuta nelle aule universitarie  
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Dr. Maurizio Mattarelli

Dip. Fisica e Geologia Università di Perugia



Group of High resolution Optic Spectroscopy and related Techniques

<https://sites.google.com/view/ghost-laboratory/home>