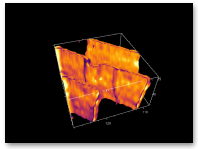
日本表面真空学会
実用顕微評価技術セミナー2025

Simultaneous Chemical and Mechanical Imaging Using the Nanofinder Raman/ Brillouin Microscope

Morten Bertz

Tokyo Instruments



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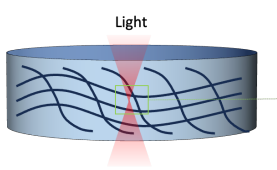
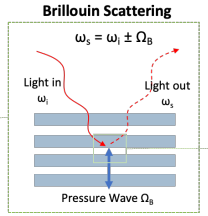
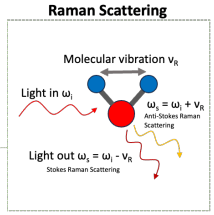
Raman vs. Brillouin Scattering

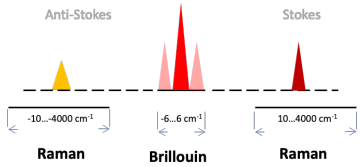






acoustic phonons

optical phonons



- low frequency acoustic phonons
- collective displacement of atoms in the same direction (**acoustic waves in solids,** lattice vibration)
- Range: up to 200 GHz or 6 cm^{-1}

➡**Physical** Information (elastic) properties of material

- high frequency optical phonons
- vibrational transitions of the bonds between neighbouring atoms
- Range: 10 cm^{-1} (300 GHz) - 4000 cm^{-1} (120 THz)

➡**Chemical** Information (molecular bonds), structure of material

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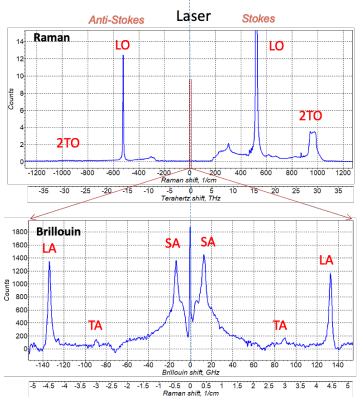

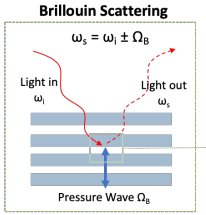

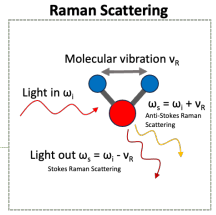

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The Tokyo Instruments Raman/Brillouin Microscopy Lineup

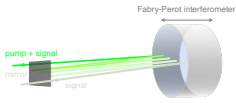
Raman/Brillouin System based on Nanofinder 30A

Raman/Brillouin System based on Nanofinder FLEX/FLEX2

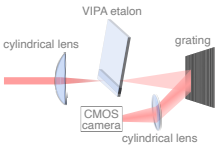
Stand-Alone Brillouin System

The Tokyo Instruments Raman/Brillouin Microscopy Lineup

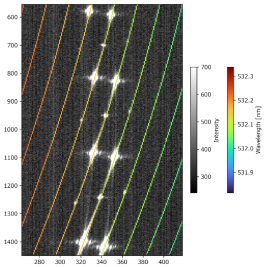
1. Pump Suppression



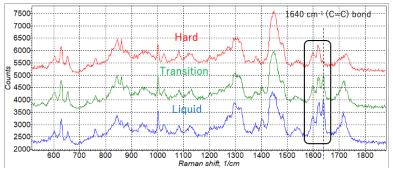
2. Cross-dispersed, VIPA-based spectrometer

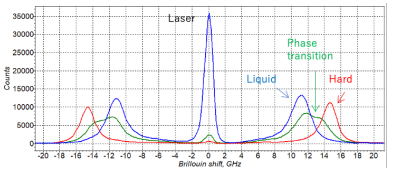


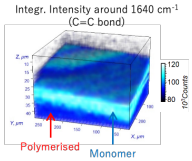
- **Powerful Pump Killer** (Fabry-Perot interferometer) for laser wavelength suppression (>55dB)
- New technology: **VIPA** (Virtually Imaged Phased-Array) + Grating
- **Wide Spectral Range (>2THz) simultaneously** (multichannel detector e.g. CMOS camera)
- **High Throughput (VIPA transmission 90%)**
- **High Spectral Resolution (<1 pm)**
- **50 Times Faster** compare with classical multi-pass Fabry-Perot interferometers

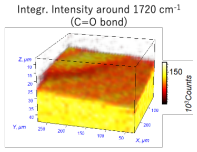


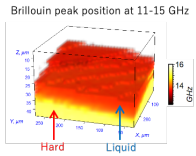
Application Example: Glue Curing

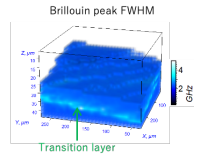






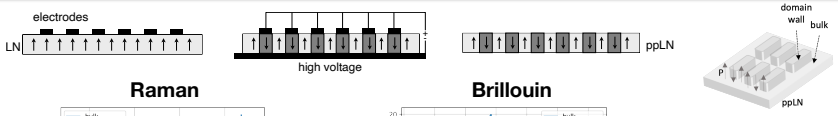




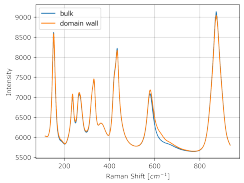


Surface layer (depth 25 µm),
Border of hardening (34 µm)
Deep inside (µm)
Laser: 532 nm
Laser power 20 mW,
Objective 50x0.5
Exposure: 1 sec

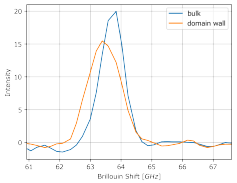
Application Example: Domain Wall Imaging in ppLN

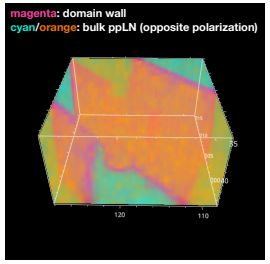


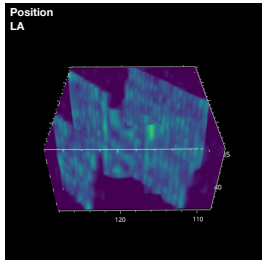
Raman



Brillouin







Sample: periodically poled lithium niobate (ppLiNbO$_3$), z-cut
0.65 µm (x & y) / 1µm (z) steps
33x33x11 (11900) points
0.3 s /point, imaging time 66 min

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アクセスはこちら！

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