Raman Polarization Measurements and Imaging

Lise-Meitner-Straße 6, D-89081 Ulm, Germany
Tel. +49 (0) 731 140 700, Fax. +49 (0) 731 140 70200
www.witec.de, info@witec.de

WITec
focus innovations

Applications:

Detection of molecular orientations, symmetry, Raman activity, specific peaks of a spectrum, molecular geometry of e.g. crystals, polymers, or liquid crystals

Working principle:

Polarization Kit: Rotation of the polarization of the incoming polarized excitation laser light.

Polarization Analyzer: Selective filter module for filtering information of a certain polarization (can be switched on/off according to the measurement requirements).

WITec Instrument Components:

Polarization Kit for excitation wavelengths of 355, 488, 514, 532, 633, or 785 nm

A manual rotator for the l/2 plate allows the rotation of the excitation laser beam. For the 355 nm excitation wavelength a l/4 plate is also available. The polarization kit is only functional in combination with a Raman laser coupler.

Polarization Kit for multi-wavelengths coupler

Manual Polarization Kit for up to three retarder plates. It allows the rotation of the polarization of the excitation laser beam. It is only functional in combination with the Raman Multi Laser Coupler.

Polarization Analyzer

- Filter module with 360° rotatable analyzer for VIS/NIR 500-1000nm.
High transmission and high contrast for 500 – 1000 nm.

- Filter module with 360° rotatable analyzer for UV 355 - 400nm.
High transmission and high contrast for 355 – 400 nm.

Description:

Raman polarization measurements are suitable for the detection of spectra with polarization information which is typically measured either parallel or perpendicular to the polarization of the excitation laser.
The Polarization Kit can rotate the polarization plane of the incoming excitation laser light. The polarization of the laser beam can be adjusted between -90° and +90° by manually rotating the wheel of the polarization kit.
The filter module of the Polarization Analyzer can either discriminate certain polarized light information and facilitate the detection of only a specific polarization state (typically perpendicular or parallel to the excitation plane) or enable the detection of the full laser light information independently from its polarization state.

Installation:

All WITec systems work with polarization maintaining optical fibers. With standard configurations the polarization of the excitation laser light is parallel to the x-axis. The Polarization Kit is inserted in the beam path by laser coupler integration. The Polarization Analyzer is installed on top of the laser coupler. The users can always choose between measurements with or without Polarization Analyzer via a slider mechanism.

Required System Configuration:

Suitable for all WITec microscope systems with single or multi laser coupler.

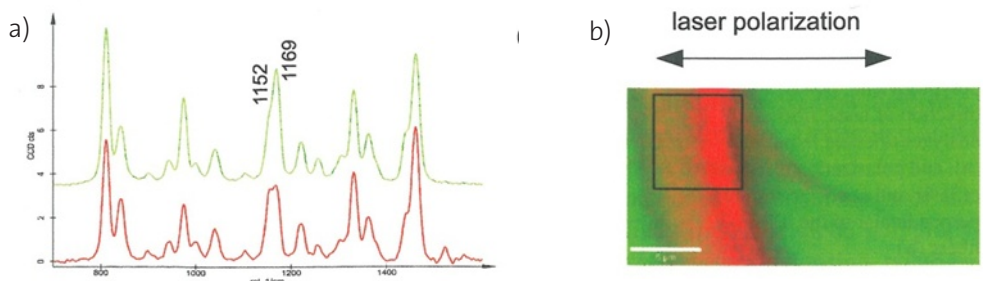

Figure 1: Raman imaging of biaxially oriented polypropylene: a) Raman spectra: The Raman bands at 1152 and 1169 1/cm are characteristic of a directional ordering of the polymer chains. The green spectrum is characteristic for polypropylene fibers oriented parallel to the laser polarization direction, whereas the red spectrum is characteristic for polypropylene fibers oriented perpendicular to the laser polarization direction. b) The corresponding color coded Raman image reveals the oriented fiber bundle.

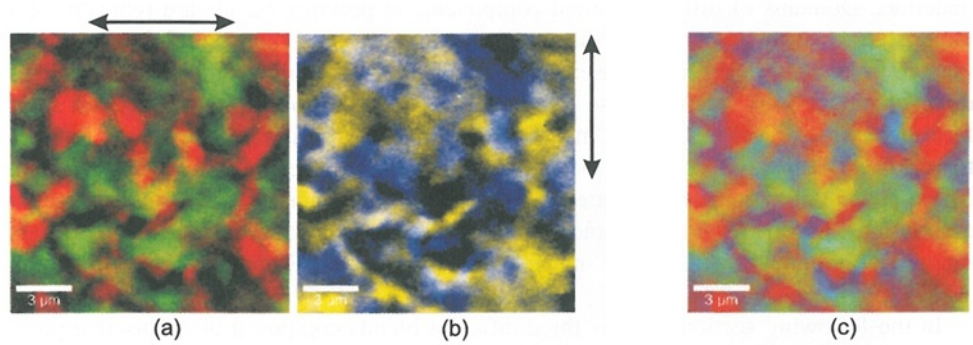

Figure 2: Color-coded polarization dependent Raman images of a polypropylene film used as a solid dielectric in capacitors: (a) Raman image of polypropylene oriented in parallel (red) and in perpendicular (green) acquired with horizontal laser polarization direction. (b) Raman image of polypropylene oriented in parallel (blue) and in perpendicular (yellow) acquired with vertical laser polarization direction. (c) Merged color-coded Raman image of (a) and (b) illustrating the differences between horizontal and vertical polarization.

Application Examples from: Confocal Raman Imaging of Polymeric Materials, Confocal Raman Microscopy, Springer Series in Optical Sciences Vol. 158; p.239 – p.244, Dieing, Hollricher, Toporski (Eds.), Springer Publishing Group, 2010