Spectroscopy Day 2015
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Abstracts

AGILENT CARY 7000 Universal Measurement Spectrophotometer (UMS) for accurate characterization of cube beamsplitters

Rob Wills, Agilent Technologies, Lakeside 5500, Cheadle Royal, SK8 3GR, UK

Contact: Robert.wills@agilent.com

Cube beamsplitters (CBS) are critical optical components that have a wide variety of uses in consumer products, high-tech micro positioning equipment, and fiber optic based telecommunication systems.

Successful CBS design, implementation and quality control rely on detailed spectral knowledge of both the transmitted and reflected beams. In situ measurement of the dielectric coating is imperative because an open air characterization, performed prior to cementing the two prism halves together, renders different results to the completed cube assembly.

In addition, data quality is affected by the difference in angles of incidence (AOI) at which T and R are measured, a slight thickness non-uniformity of the film and an absorption in a thin film acting in combination with interference effects.

In this presentation we will show evidence that demonstrates how, using the Cary 7000 UMS, both T and R have been measured without moving the sample and hence, eliminating the source of AOI variations and coating thickness non-uniformities. The in situ measurement of transmission (T) and reflection (R) from identical locations on the sample permit accurate Absorptance (A = 1–T–R) data to be calculated, providing greater insight into substrate and coating properties.

The birth and life of a startup company.

cruising down the road of a real life challenge - no map provided

Stefan Ovesen, RSP Systems, Egelundsvej 18, 5260 Odense S, Denmark

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Linear Variable Filters for Applications in Spectroscopy and Hyper Spectral Imaging

Henrik Fabricius and Oliver Pus,t Delta Optical Thin Film A/S

Deltas range of Linear Variable Band pass Filters was extended to cover the wavelength range from 320nm to 1000nm. All dielectric blocking of OD3 – OD4 is offered in the wavelength range of silicon sensors . The first LVBP filters did have a relative bandwidth of 2.8% and a relative shift in center wavelength of 8nm/mm. We have now successfully reduced the relative bandwidth to start at 0.6% to 1.2% and we offer LVBP filters with a relative shift of the center wavelength of up to 25nm/mm. The new generation of LVBP filters fit camera chips and targets Hyper Spectral Imaging. We will show how to test the spectral performance at pixel level with a camera-based technique and narrow-banded illumination. Finally, results are presented on a new kind of linear variable laser attenuator named LOMA.

A Method for Controlled Oxidation of Lube and Hydraulic Oils and Investigation of the Effects on Oil Parameters

Morten Henneberg , C. C. Jensen A/S, Svendborg, Denmark and Department of Technology and Innovation, University of Southern Denmark, moh@cjc.dk
René Lynge Eriksen, Department of Technology and Innovation, University of Southern Denmark
Frank Müller, Department of Technology and Innovation, University of Southern Denmark

A controlled method is presented for accelerated oxidation of three different base oils. The technique controls the factors triggering oil oxidation by adding heat, a catalyst in the form of a carbon and copper steel wire, oxygen and water to the oil under the degradation process.

The effect of the oxidation is studied by different in- and offline measurement techniques such as FTIR spectroscopy combined with multivariate analysis.

Spectral distribution affects you work

Subline: Recent research shows new knowledge between the light source and our brains.

Asger Bay Christiansen, cand. arch., Laboratoriet LYS & SYN

THz spectroscopy – Today and tomorrow

Peter Uhd Jepsen, DTU Fotonik, Denmark

Optical spectroscopy in the far-infrared, or terahertz (THz) spectral range has been an established technique for decades, and is still rapidly evolving due to continuing technological advances in source and detector performance and functionality. This development is partly fueled by concurrent advances in ultrafast laser technology which now allows for phase-stable spectroscopy across the THz band using ultrashort THz pulses. The ultrashort pulses allow for strong fields and femtosecond time resolution in spectroscopic measurements, a modality which now allows for ultrafast, nonlinear spectroscopy in the THz range. Novel near-field techniques enables THz spectroscopy with few-nanometer spatial resolution which opens up for future applications of long-wavelength spectroscopy of individual nanoparticles and even single molecules.

A novel speckle-based wavemeter

Michael Linde Jakobsen, DTU Fotonik

A novel wavemeter will be disclosed. The working principle is based on tracking the displacement of a speckle pattern as the incident wavelength is changed. In this way the system works as an extremely low-cost Fabry-Perot-type wavemeter without having the deficiency of a Free Spectral Range, which results in an ambiguity of the measured spectral change. A resolution of 100 MHz for a coherent source is presented for measurement between static states of the emission from a laser. It will be shown how wavelength changes with a temporal scale beyond 1 nsec can be probed simultaneously with probing the fast accompanying changes in the emitted power.

In situ Marine Emission Sensor

René Skov Hansen, Stolberg-Rohr Thomine, and André Fettouhi, Danfoss IXA A/S, Ulvehavevej 61, DK-7100 Vejle
Rene.Skov.Hansen@danfoss.com

At Danfoss IXA A/S we are developing an In-situ emission sensor for large marine engines. The sensor optics is placed directly into the exhaust pipe of the engine. Using UV spectroscopy, the sensor continuously measures the amount of NO, NO_2, SO_2 and NH_3 in the exhaust gas. The sensor is intended for use both directly after the turbo charger of the engine, and in relation to after treatment systems like e.g. Selective Catalytic Reduction (SCR), Exhaust Gas Recirculation (EGR) and scrubber systems.

Mid-infrared nonlinear upconversion spectroscopy and imaging

Peter Tidemand-Lichtenberg and Christian Pedersen, DTU Fotonik, Technical University of Denmark, DK-4000 Roskilde, Denmark

Mid-infrared light in the 1.5 to 10 µm range is important for a range of spectroscopic applications, as many important molecules have their fundamental absorption band in this region.

A major challenge in this highly preferred optical band has been severe technological challenges related to low-noise detection. We apply nonlinear upconversion techniques, using diode-pumped solid-state laser technology, followed by visible light detection, to demonstrate low noise mid-IR spectroscopy and mid-IR imaging even at room temperature operation.

Different aspects of mid-infrared upconversion spectroscopy and imaging will be presented as well as examples of practical applications.

Luminescence imaging and spectroscopy with the Risø TL/OSL reader

Torben Lapp, DTU Nutech (Center for Nuclear Technologies)

The Luminescence Research Group in Nutech at Risø has for many years used and produced an instrument for measuring the luminescence signal from a sample that has absorbed a dose of ionising radiation. The light level of these luminescence signals is very low, and until a few years ago the only realistic optical detection device was a PMT. The EMCCD (Electron Multiplying Charge Coupled Device) camera has made it feasible to think of imaging and spectral acquisition of luminescence at low light level. The Luminescence Research Group has developed a flexible detection and stimulation head (DASH) that has made it possible to change between normal, imaging and spectral acquisition. This presentation will show how this is done with the newly developed DASH.

Precision measurements with lasers

David Balslev-Harder, DFM A/S

DFM is the Danish national metrology institute and one of the nine Danish GTS institutes. Besides providing calibration services, DFM has a vast number of development activities within spectroscopy. This presentation will give an overview of these activities including: Wavelength standards for optical telecommunication region applying gas filled hollow-core fibers. Primary method based on laser spectroscopy for chemical metrology and trace gas analysis using Tunable Diode laser spectroscopy and Cavity Ring Down Spectroscopy, along with new developments for high precision compact gas sensors applying photo acoustic spectroscopy. Finally Raman spectroscopy is a new major initiative at DFM, and results on Differential high-resolution stimulated cw Raman spectroscopy of hydrogen in hollow core fiber will be presented.

Time-resolved photoluminescence spectroscopy of organic-plasmonic hybrids

Till Leißner [a,b], Jonathan R. Brewer[b], Jacek Fiutowski[a], and Horst-Günter Rubahn[a]

[a]NanoSYD, Mads Clausen Institute, University of Southern Denmark, Alsion 2, 6400 Sønderborg, Denmark;
[b]Department of Biochemistry and Molecular Biology, University of Southern Denmark, Campusvej 55, 5230 Odense, Denmark;

We study the optical properties of organic thin films and crystalline organic nanofibers as well as their interaction with plasmonic materials by means of laser-scanning fluorescence lifetime imaging microscopy (FLIM) and time-resolved photoluminescence spectroscopy (TR-PLS). The aim of our research is to understand and developed organic-plasmonic hybrid systems with tailored optical and plasmonic properties such as wave-guiding, enhance second-harmonic response and lasing. We are able to image, gather information about the fundamental coupling mechanism, as well as study charge-carrier dynamics in such systems.

In this contribution we will show how the interaction of organic nanofibers placed on top of regular arrays of nanostructures leads to a significantly enhanced second-harmonic response and, at the same time, an increased decay rate of the photoluminescence lifetime.

Spatially/temporally resolved detection of 'dark' molecular species in flames using non-liner IR laser spectroscopy

Zhongshan Li, Division of Combustion Physics, Lund University, P.O. Box 118, S221 00 Lund, Sweden

Laser combustion diagnostics has been well established in the UV/visible spectral range for detection of minor species, e.g. OH, CH, NO, NH in combustion environments by probing strong electronic transitions. However, many combustion important molecular species like C_2H_2, CH_4 and other small hydrocarbon molecules and radicals, toxic species, e.g. HCl, HF, HCN, NH_3, OCS, which possess no convenient accessible strong electronic transitions in the UV/visible spectral, are hidden in 'dark' from sensitive laser spectroscopic in situ detections. As fully resonant enhanced nonlinear techniques technique, Polarization Spectroscopy (PS) and Degenerate Four-Wave Mixing (DFWM) probing molecular ro-vibrational transitions in the mid-infrared spectral range especially the H-X stretching band form the most promising way for optical measurement of the above mentioned molecular species in harsh environments. This presentation will include the detection of C_2H_2, HCN and HCl molecules performed in flames and nonreactive flows, which demonstrated the sensitivity of IRPS/DFWM for minor species detection at harsh environments. Water is a common species in most of the interested conditions and has very complicated spectral structures in the mid-infrared spectral range especially at elevated temperature. The potential inference from hot waterlines and the possibility of using hot water lines as sensitive temperature measure will be discussed.

Freedom: Compact spectrometers with high performance

Thomas Rasmussen | VP Business Development and Sales & Marketing, Ibsen Photonics A/S