

# Conference Report

## 11th Confocal Raman Imaging Symposium a Huge Success

Many international researchers joined the 11th Confocal Raman Imaging Symposium from 29th September to 1st October 2014 in Ulm, Germany. The well-established conference is a popular event at which the Raman community can present and discuss its latest scientific results. Talks from various fields of application and over 20 poster presentations provided a comprehensive overview of modern Raman microscopy for the 80 participants. Another conference highlight was the presentation of the new Raman and Scanning Electron Microscope RISE.

On the first day of the symposium Professor Dr Sebastian Schlücker from the University of Duisburg-Essen, Germany, began the scientific talk session with an introduction to the theoretical basics of Raman spectroscopy. With several examples from experience and quantum-mathematical descriptions Schlücker explained the Raman scattering effect. Furthermore he discussed the Resonance Raman effect and described specific Raman techniques such as surface-enhanced Raman scattering (SERS) and non-linear Raman spectroscopy. Afterward the audience participated in an interactive quiz that evaluated their theoretical and practical Raman knowledge.

Next was the contributed talk session for which three distinguished researchers were selected from among the submitted abstracts. Dr Dieter Fischer from the Leibniz-Institute for Polymer Research in Dresden, Germany, introduced his work on micro-plastics in the Baltic Sea. These particles appear from cosmetics and cleaning products or are debris of larger plastic pieces and pose a threat for aquatic animals and coral reefs. Fischer investigates the micro-plastic particles with topographic, large-area Raman imaging to determine the particle size, type, and distribution. Fischer mentioned sensible, global recycling management and the avoidance of plastics usage as solutions for increasing environmental pollution.

In the next presentation Andrey Denisjuk from the Czech company Tescan talked about correlative microscopy techniques for electron microscopy. In addition to EDX Denisjuk showed several results acquired by the new Raman-SEM combination from various fields of application.

The first session closed with a talk from Chunxiao Cong from Nanyang Technological University in Singapore. Cong presented her impressive confocal Raman imaging results on graphene. Cong's focus is on the investigation of wrinkles and shear forces in graphene layers and temperature-dependent interactions of graphene particles with phonons. She has already successfully published some of her results in the journals Nature Materials and Nature Communications.

The evening talk was given by Professor Dr Albert Zink from the EURAC Institute for Mummies and the Iceman in Bozen, Italy. Zink took the audience on a fascinating journey to the Ötztal Alps and described the impressive research surrounding the glacier mummy Ötzi. To clarify Ötzi's cause of death Raman microscopy was employed among other techniques. Red blood cells, collagen fibres, and fibrin were directly isolated from Ötzi's wounds and investigated by Raman spectroscopy in order to estimate the status of wound healing of his numerous injuries. The investigations of Zink and his research group clearly show that Ötzi's shoulder wound, which resulted from an arrowhead penetration, caused his death.

On the second day of the symposium, Dr Olaf Hollricher, WITec Managing Director R&D, started the talk session with a practical introduction to confocal Raman microscopy and instrument configurations. He provided useful information on characteristics and specifications of Raman microscope systems and explained their impact on and spectral resolution.

In the presentation that followed Dr Ute Schmidt and Dr Thomas Dieing from WITec illustrated various applications of Raman microscopy. Schmidt and Dieing explained the generation of 3D Raman images and introduced Raman techniques such as topographic TrueSurface Microscopy and Raman-, Atomic Force- and Electron-Microscopy combinations.

The subsequent talk session included life science presentations. Professor Dr Klaus Gerwert from Ruhr-University in Bochum, Germany gave a talk about using Raman microscopy to study changes in cellular proteins that regulate the proliferation and death of cells. The aim is to develop a new method for the early detection and diagnosis of colon cancer that provides more precise and more reliable results than present techniques. In order to generate compelling results, Gerwert and his team combined IR and Raman spectroscopic data. The data should be included in a computerised database and used for the automatic differentiation between neoplastic and non-neoplastic tissues.



Group picture of the conference attendees.

During the next talk Clara Stiebing from the Leibniz-Institute for Photonic Technology in Jena, Germany, presented her work on lipid metabolism in macrophages. Lipid uptake and storage in macrophages is related to the appearance of atherosclerosis. Stiebing showed confocal Raman imaging results of the uptake of different fatty acids in macrophages over time. She could show that in contrast to arachidonic acid, palmitic and oleic acid are well absorbed by the macrophages and this can increase the risk of atherosclerosis.

The topic of the presentation from Dr Admir Maši of the Max Planck Institute in Potsdam, Germany was the investigation of structures and compositions of various biological materials with topographic confocal Raman microscopy. Maši presented comprehensive results of his work on the bio-mineralisation of crayfish mandibles, orientations in collagen fibres of bones, and calcium-containing tissues and vessels in living fishes.

The afternoon session began with Dr Christian Weikusat from the Alfred Wegener Institute in Bremerhaven, Germany. He investigates the composition of ice cores from Antarctica to draw correlations with climatic changes. To prevent melting of the ice cores, the complete Raman investigations were performed in a cryo-lab. Weikusat analysed the gas composition of air pockets in the ice. Furthermore he generated 3D Raman models of air hydrate crystal structures in ice to calculate their volumes. Air hydrate crystals emerge at great depth under high pressure from air bubbles in ice. Through his analysis Weikusat obtained information about the gas composition of the atmosphere during past climatic periods.

The succeeding talk was given by Dr Paul Pudney from Unilever Discover in the UK. Pudney presented his studies of different contents in consumer goods with a primary focus on investigations of hair treatment products. He analysed the penetration depth of certain substances such as resorcinol or glycerol in hair with Raman depth profiles and applied confocal Raman imaging to investigate changes in the hair structure through humidity.

Professor Dr Sabine Hild from Johannes Kepler University in Linz, Austria, talked about her research on polymers and the correlation of micro-structures and materials characteristics. She investigated crystalline structures, polymorphisms, macro-molecular orientations and the tacticity of polymers with confocal Raman microscopy. The acquired results give her insights into the material characteristics of the polymers.

Professor Dr Ting Yu from Nanyang Technological University in Singapore reported on the work of his research group in the field of graphene. Yu and colleagues investigated not only graphene layers, defects, strains, electrical and chemical doping, thermal conductivity and quantum interference but also electron movement in graphene. Furthermore his research focus is on the investigation of other 2D materials such as tantalum-disulphide, molybdenum-disulphide and wolfram-disulphide.

The contributed component was then closed by Dr Martin Süess from ETH Zürich in Switzerland. Süess investigated semiconductors and the possibility of increasing their efficiency through strain states. He studies strain states in 25 nm small silicon nano-bridges with confocal Raman microscopy.

During the third day of the symposium the participants had the chance to receive more practical information about Raman microscopy systems during the instrument and software demonstration at WITec headquarters. In addition to Raman and AFM demonstrations, the new Raman-SEM microscope RISE was also introduced.

The 12th Confocal Raman Imaging Symposium will be held from September 28th to 30th 2015 in Ulm, Germany.