Linear and non-linear Raman spectroscopic characterization of smart polymers and photocatalytic systems

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The analysis of polymer integrated molecular species or units presents a central challenge. Common analysis methods in synthetic chemistry such as NMR and mass spectroscopy are challenging for characterizing polymer-integrated systems. While these methods offer high molecular sensitivity, they suffer from overlapping bands and poor signal strength in polymeric environments preventing useful access to active centres inside soft matter.

Here, we will show that Raman spectroscopy offers an alternative to analyse soft-matter integrated species via characteristic Raman marker bands. Examples will be the Raman spectroscopic characterization of molecular mechanisms of polymer-based self-healing. Here, special emphasize was among others placed on the interplay between mass transport (diffusion) and chemical reactivity, which was investigated by coherent anti-Stokes Raman scattering (CARS) microscopy and compared to classical light scattering. It was demonstrated that the occurring chemistry and the overall flow of the material do not necessarily correlate. In a second example binding conditions of polymer integrated photocatalysts or sensitizer have been studied together with the molecular shape switching mechanism behind multiple intelligent polymers (e.g., shape memory metallopolymers).

For the analysis of the observed Raman spectra tailored 2D correlation analysis routines have been developed.

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Michael Schmitt, born in 1968, received his Ph.D. in chemistry from the University of Würzburg in 1998. From 1999 to 2000 he went for postgraduate studies to the Steacie Institute for Molecular Sciences at the National Research Council of Canada. He subsequently joined the group of Prof. Dr. W. Kiefer at the University of Würzburg, where he finished his habilitation in 2004. Since March 2004 he has been a research associate in the group of Prof. Dr. J. Popp at the Institute of Physical Chemistry at the Friedrich-Schiller-Universität Jena. His main research interests are focused on resonance Raman spectroscopy, non-linear spectroscopy and non-linear multimodal imaging for biomedical and material research. He has published more than 260 publications in peer reviewed journals with a citation rate of 9329 resulting in an h-index of 51. In 2018 he won the Kaiser-Friedrich-Forschungspreis.