Raman Imaging is a powerful method to obtain chemical information about the phase separation of biopolymer and polymer blends. Polymer blends are often mixtures of two different polymers with improved properties in comparison to the individual polymers. However, they tend to phase separation caused by immiscibility. To overcome this, it is often necessary to use a compatibiliser, which is enriched between the phase interfaces to connect the immiscible phases. The interactions between the polymer compounds in blends at the interfaces significantly affect the resultant morphology and thus the macroscopic properties. Furthermore, it is necessary to investigate the phase characteristics and their changes at different processing conditions.

We show three examples where Raman Imaging provides new insights in the phase behavior of polymer blends:

- Investigation of the influence of the temperature on the phase separation of the biopolymer blend poly(3-hydroxybutyrate) (PHB)/poly(l-lactic acid) (PLA)
- Investigation of the influence of the composition and the production process on the phase separation of the biopolymer blend poly(3-hydroxybutyrate) (PHB)/poly(ε-caprolactone) (PCL)
- Investigation of the influence of the compatibiliser maleic anhydride grafted polypropylene (PP-g-MA) on the phase separation of the polymer blend polypropylene (PP)/ polyamide 6 (PA6) at different composition

Raman measurements were carried out with the Confocal Raman Microscope alpha300R (WITec GmbH, Ulm, Germany) with a heatable stage at temperatures from 25 °C to 175 °C. The measured area was up to 175 x 175 μm with a data point distance of 500 or 1000 nm.

PHB/PLA: PHB-rich and PLA-rich phases could be detected at selected temperatures, although no contrast was observable in the visible image. PHB-rich domains coalesce to bigger phases with increasing temperature up to the melting point of PHB at 175 °C.

PHB/PCL: Images show changes in phase separation for the three different production processes used. Compounded samples from granulates and melt film samples are both homogeneous; however, the compounded sample has smaller phases as the melt film samples. Precipitated samples are more heterogeneous and have much larger phases as the both other samples.

PP/PA6: The blends without compatibiliser show a strong phase separation with heterogeneous distributed PA6 particles in PP with strong differing particle sizes between 1 and 15 μm. For different blend compositions without compatibiliser we could not find differences in the particles size of the PA6 in the PP matrix. Blends with compatibiliser
strongly influence the morphology of the blend. The blends show a completely different phase behavior with domains of PA6, which are much smaller and more homogeneously distributed in PP. Furthermore we found different morphologies for these blends for different compositions. The compatibiliser works best to prevent phase separation, if one component is below 35%.