Combining Raman with Scattering Methods to Study Silica in Plant Materials

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To plants, silica is available due to its presence in soil and dust. This inorganic component is known to increase yields of crops and to mitigate biotic and a-biotic stresses by improving plant fitness. The absorption of silica might involve the transport from the roots through the transpiration stream to the epidermis and epidermal features.[1] Although there are many studies about silica bodies [2] and the presence of silica in biochemical and biophysical processes in general, most of the mechanisms leading to silicification are not fully understood. Therefore, we focus on the investigation of plant cells from cell cultures and pollen as a model system to find a connection between the molecular composition and the microscopic and macroscopic structure of a plant cell during the silicification process. To achieve this, we combine physiological experiments with cells and pollen with different techniques that provide data on molecular structure of the inorganic silica, the complex organic plant material, and the cellular morphology. The challenge of our project is to combine the information from spatially resolved optical microspectroscopy, specifically Raman scattering with X-ray scattering techniques such as Wide and Small Angle X-Ray Scattering (WAXS and SAXS) to study inorganic material in a complex biomatrix. Up to now a combination of both methods was only possible for very well-defined molecules [3].
In our poster, we present experiments with germinated pollen grains from different species. We discuss imaging results of the germination process that we obtained by Raman scattering, thereby extending the information of previous data [4]. Furthermore, we present first data of our WAXS experiments with horsetail done at µ-Spot beamline of BESSY II, Berlin. These results demonstrate that our proposed experimental approach is feasible.

References:

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