

Sample Preparation Methods

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Scanning Electron Microscopy of biological samples without metal coating: Utilizing bulk conductivity for enhanced preparation flexibility

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Our studies of plant surfaces by scanning electron microscopy induced several requirements that exceeded the possibilities of the standard CP-drying preparation. The study of contaminations and drop-surface interactions on superhydrophobic samples, material contrast imaging with backscattered electrons, and various other applications motivated us to develop a line of tailored preparation and microscopy techniques.

Several of these methods provide the samples with sufficient internal electrical conductivity that they can be imaged without metal coating in a conventional high-vacuum SEM. Our methods use some surprising properties of the samples. The low water permeability of plant surfaces, the low vapour pressure of some liquids, and the protonic conductivity of some liquids and of ice at cryogenic temperatures enabled the design of unusual but often simple methods. The presented methods range from imaging of fresh hydrated plant samples over cryo-SEM to special chemical treatment of bio-organic material to obtain the necessary conductivity. The proton conductivity occurs in liquids such as water or glycerol as well as in solids such as ice at temperatures above -100°C, and in chemically treated dry organic material at room temperature.