ORNL scientists report suitability of a new mode of AFM to characterize lignocellulosic biomass

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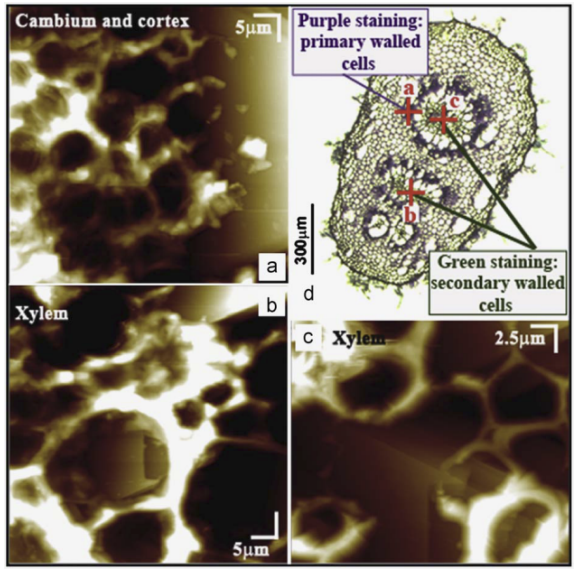
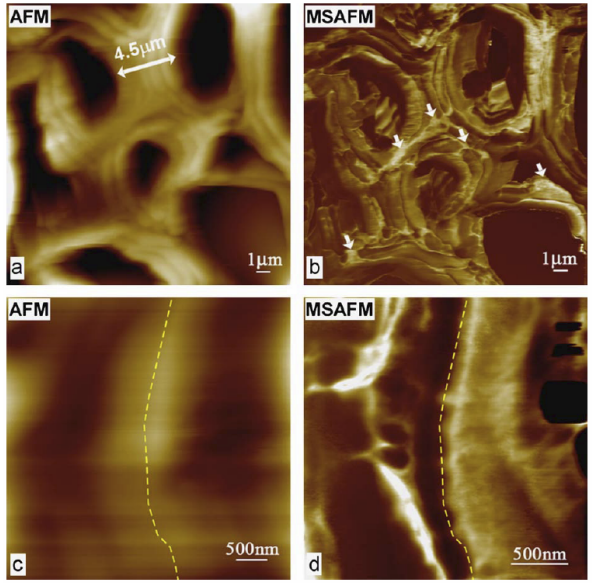


Left: (a-c) AFM imaging representative of the primary (cambium and cortex) (a) and secondary (xylem) (b,c) cellwalls.

Right: AFM (left) and MSAFM (right) images of a cross section of *Populus* wood. MSAFM images exhibit different information from regular topography.



- We report adaptation of a new imaging technology to study lignocellulosic biomass materials at nanoscale level.
- Mode synthesizing atomic force microscopy (MSAFM) was demonstrated to be suitable in conducting nanoscale topography and subsurface imaging for *Populus* and switchgrass samples.
- Use of a single mode of MSAFM revealed variations in mechanical properties of the different layers of the cell walls, as well as the differences of composition within the tissue sample.
- Additionally, FTIR spectroscopic characterization of similar samples was undertaken to evaluate differential wall chemistries.
- In the future, cross-linking the lines of information from various technological platforms will be needed to gain a greater understanding of the plant cell wall architecture in order to improve lignocellulosic feedstock properties for bioenergy production.

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“Spectroscopy and atomic force microscopy plant biomass”

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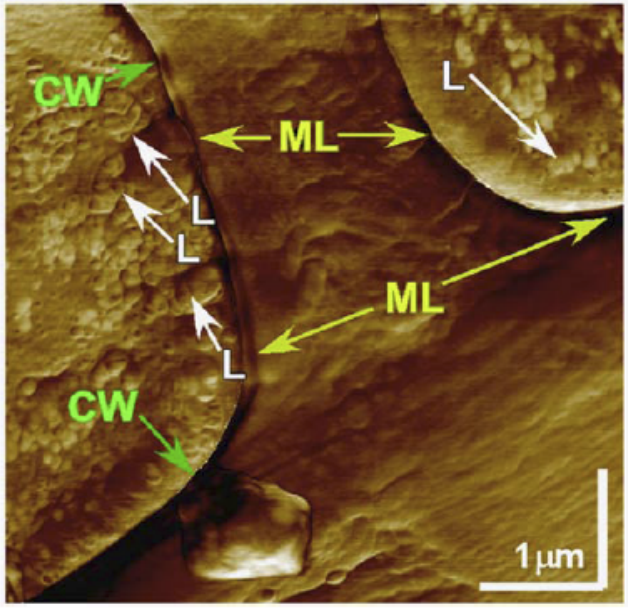
Scanning probe microscopy has emerged as a powerful approach to a broader understanding of the molecular architecture of cell walls, which may shed light on the challenge of efficient cellulosic ethanol production. We have obtained preliminary images of both *Populus* and switchgrass samples using atomic force microscopy (AFM). The results show distinctive features that are shared by switchgrass and *Populus*. These features may be attributable to the lignocellulosic cell wall composition. Using both AFM and a single case of mode synthesizing atomic force microscopy (MSAFM) to characterize *Populus*, we obtained images that clearly show the cell wall structure. The results are of importance in providing a better understanding of the characteristic features of both mature cells as well as developing plant cells. In addition, we present spectroscopic investigation of the same samples.



AFM image of *Populus* cells observed on a sample of stem shavings.

Tetard L, Passian A, Farahi RH, Kalluri UC, Davison BH, Thundat T.; “Spectroscopy and atomic force microscopy of biomass.” Ultramicroscopy doi:10.1016/j.ultramic. 2010.02.035 (2010).

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