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Resonant Soft X-ray Scattering of Cellulose Microstructure in Plant Primary Cell Walls DAN YE, SARAH N. KIEMLE, The Pennsylvania State Univeristy, CHENG WANG, Lawrence Berkeley National Laboratory, DANIEL J. COSGROVE, ESTHER W. GOMEZ, ENRIQUE D. GOMEZ, The Pennsylvania State Univeristy — Cellulosic biomass is the most abundant raw material available for the production of renewable and sustainable biofuels. Breaking down cellulose is the rate-limiting step in economical biofuel production; therefore, a detailed understanding of the microscopic structure of plant cell walls is required to develop efficient biofuel conversion methods. Primary cell walls are key determinants of plant growth and mechanics. Their structure is complex and heterogeneous, making it difficult to elucidate how various components such as pectin, hemicellulose, and cellulose contribute to the overall structure. The electron density of these wall components is similar; such that conventional hard X-ray scattering does not generate enough contrast to resolve the different elements of the polysaccharide network. The chemical specificity of resonant soft X-ray scattering allows contrast to be generated based on differences in chemistry of the different polysaccharides. By varying incident X-ray energies, we have achieved increased scattering contrast between cellulose and other polysaccharides from primary cell walls of onions. By performing scattering at certain energies, features of the network structure of the cell wall are resolved. From the soft X-ray scattering results, we obtained the packing distance of cellulose microfibrils embedded in the polysaccharide network.

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