PHYSICAL AND CHEMICAL CHARACTERIZATION OF PLANTS RESPONSE TO EXTERNAL MECHANICAL AND CHEMICAL STRESSES

Mikhael Soliman[a,b], Laurene Tetard[a,b*]*

[a] NanoScience Technology Center,

[b] Department of Materials Science and Engineering,

University of Central Florida, Orlando, Florida

E-mail: Laurene.Tetard@ucf.edu

Natural plants responses to environmental stresses constitute a key component for the design of new treatments to attain successful biofuel production and effective disease management. As a result, tools capable of improving our understanding of molecular interactions in plants are of high interest.

In this study, we focus on mechanical stresses that cause the Poplar plants to form an extra layer (G layer) in their cell walls to provide structural support, also known as tension wood. The process of formation of the new layer, which is mainly made of cellulose, is of interest for biofuel applications. The ability to determine the nanoscale structure and composition of this layer to compare its properties and interactions with adjacent layers is highly desired. However, nanoscale studies of plant systems remains extremely challenging.

Here, we present various characterization techniques used to further our understanding of the effects of these external stresses on the plant systems. Confocal Raman microscopy is used to identify changes in the cell wall composition and structure in the G layer of Poplar tension wood. Pulsed Force Microscopy (PFM) and Atomic Force Microscopy (AFM) also used to map changes in stiffness across the different layers of the cell walls. Finally we present some nanoscale infrared mapping of the plant cell wall obtained with nanoscale infrared imaging and discuss the challenges that should be addressed to better our platform for plant characterization.