Biomimetic wood mineralization: The influence of wood structure and chemistry on mineral formation

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Looking beyond the practicality of wood as a construction material, due to its natural structural hierarchy, wood presents an interesting organic scaffold for the study of biomimetic mineralization, at the wood cell wall level (below 5nm). Both the microscopic scale with vessel and tracheid lumina (for water transport in living trees) and the nanoscopic scale with nanopores in the hydrated cell wall provide a highly suitable and diverse environment for the mineralization under confinement. Additionally, the chemistry of the wood polymers (i.e. hydroxyl groups of cellulose, hemicellulose, and lignin) allows for a tunable surface chemistry with acidic binding groups (e.g. carboxyl functionalities).

Recent reports [1] [2] have demonstrated not only the fesability of mineral formation in the wood structure but detail how the cell lumina and the native wood polymer chemistry of the cell wall can influence the mineral phase, which, in the case of calcium carbonate, was the stabilization of less stable polymorphs.

The present work demonstrates through various mineral systems (e.g. calcium carbonate, calcium phosphate, and magnesium hydroxide) the effect of natural wood structure and chemistry, as well as modified wood cell wall surface chemistry, on the formation of the various mineral phases. Raman spectroscopy and WAXS mapping of wood cell walls are used for the observation and identification of mineral phases on the sub-micron length scale.

[1] Merk *et al*. (2014) *ACS Applied Materials and Interfaces*, **6, 12**, 9760-9767 [2] Merk *et al*. (2014) *Green Chemistry*, **17**, 1423-1428