

# Wood Phantoms as Reference Material for Machine Learning Optical Spectroscopy of Construction Wood.

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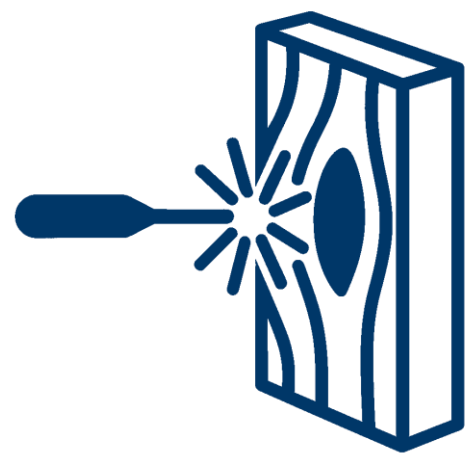
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## Introduction

The main goal of this research is to determine possibility to use wood phantoms, mimicking optical properties of real wood, as a reference material for future optical analysis of construction wood.

This study focuses on the evaluation of Raman spectroscopy as a viable method to study wood samples. It compares different phantom samples with varying amounts of cellulose to see how the mixture affects the results.



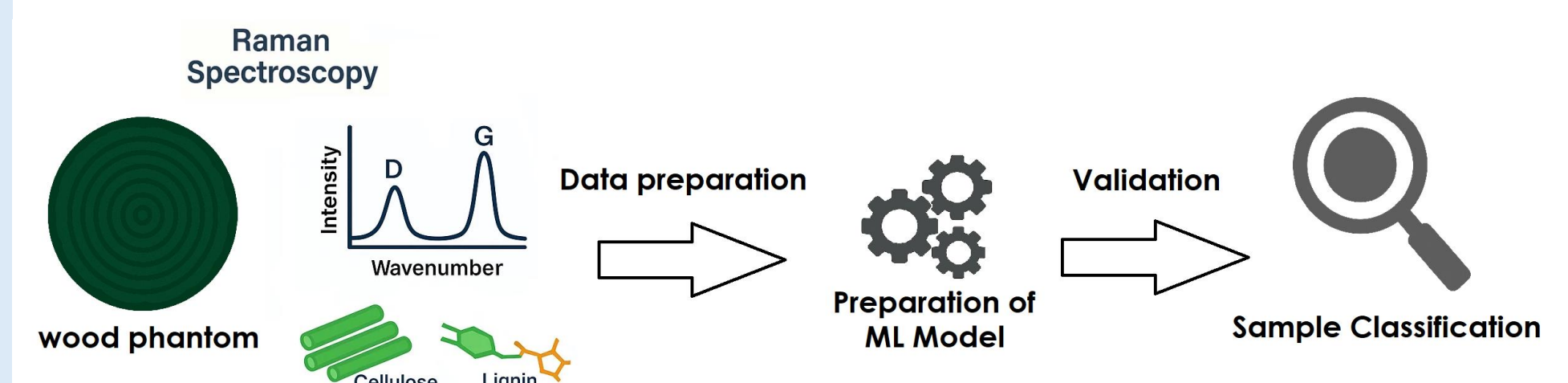
## Measured Samples

- **Material** – Wood phantoms, consisting of composite slabs made from cellulose and resin.
- **Diversity** – Five samples with cellulose content ranging from 10% to 50% by weight.
- **Note** – The phantoms are not homogeneous, their grainy structure complicates precise measurement.

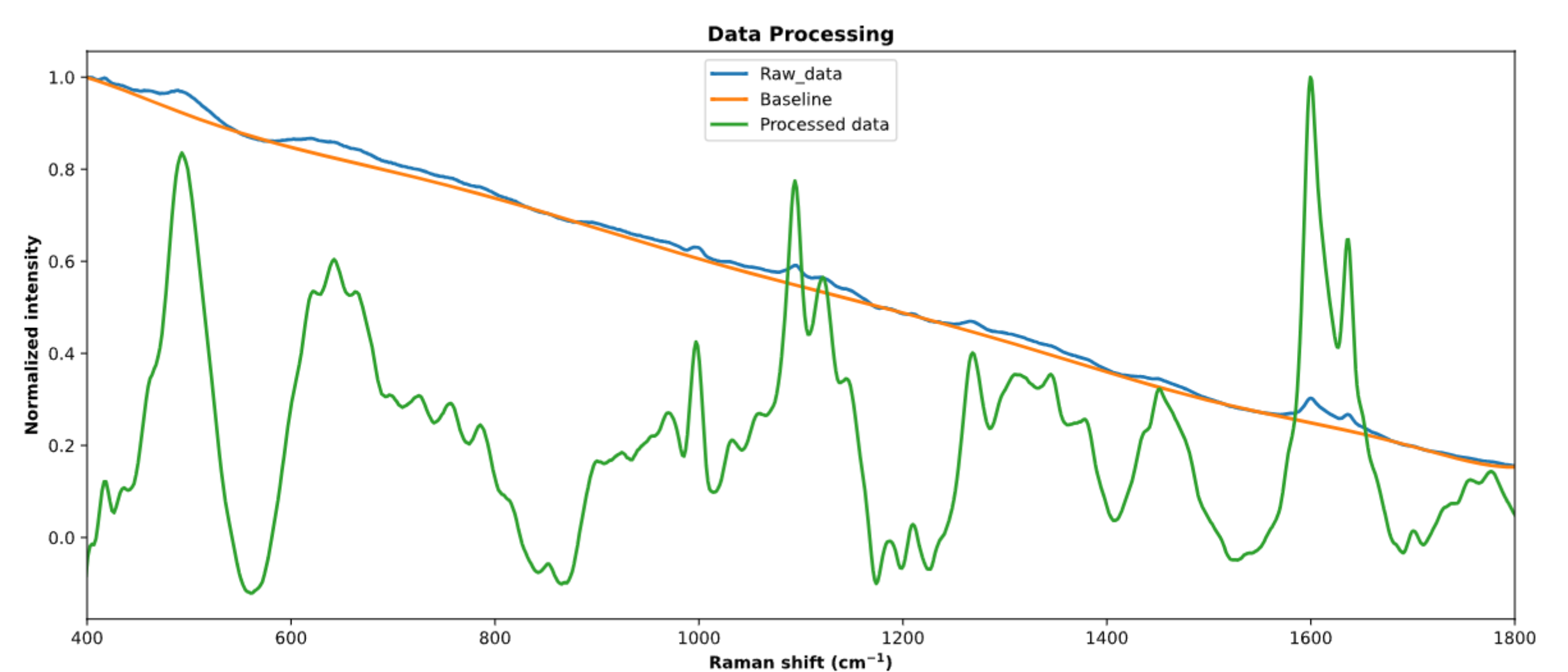
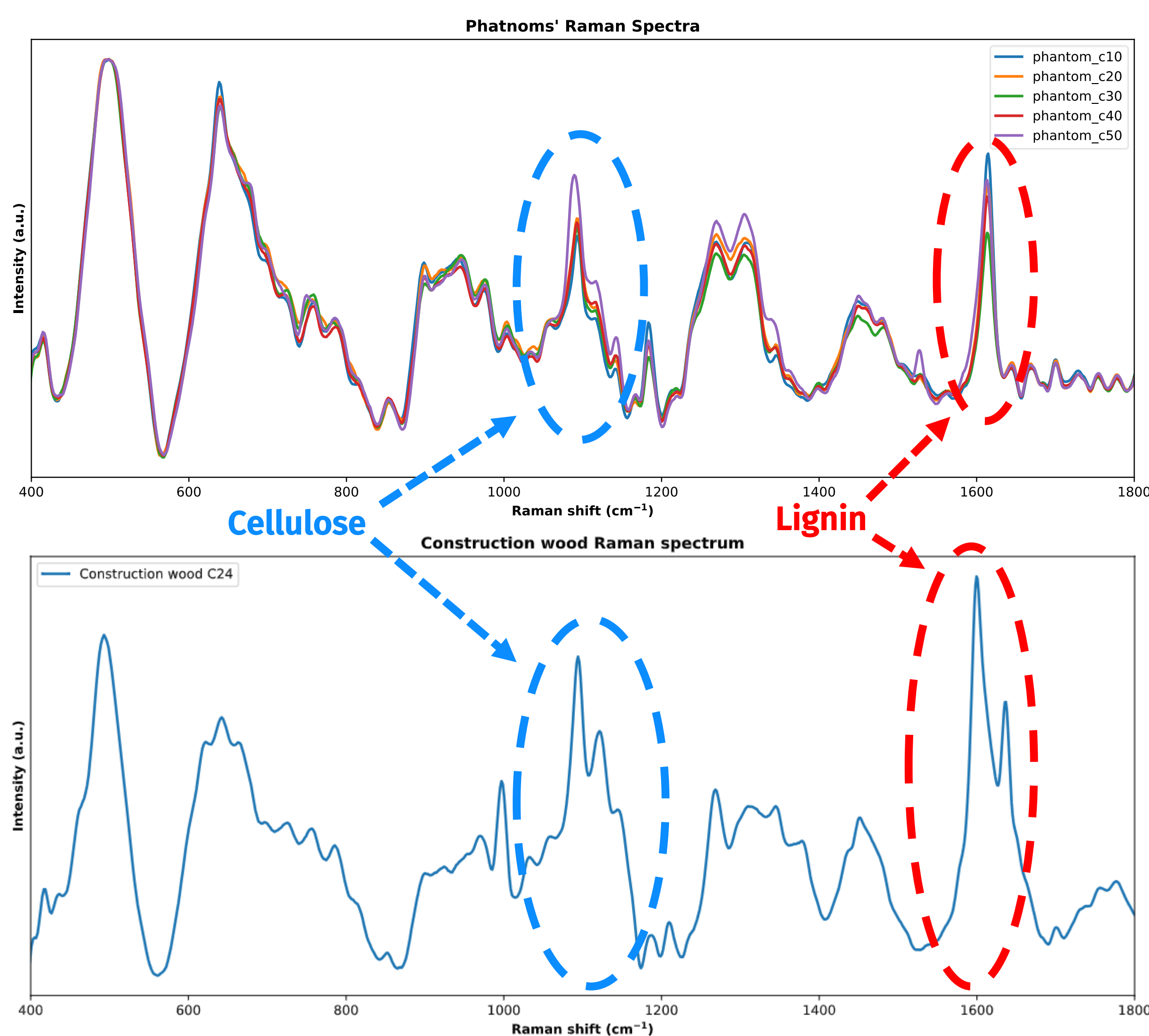


## Methodology

- **Setup** – An 830nm light source was used in the measurement system to reduce fluorescence background.
- **Measurement** – Each sample was measured at multiple locations to check the influence of the grainy structure.
- **Data preparation** – Spectrometer results were post-processed using baseline correction and smoothing algorithms to eliminate background signals and reduce excessive noise.



## Results & Discussion



Raman spectra of the wood phantoms show:

- **Well-defined peaks** corresponding to **cellulose** and **lignin**,
- **Differences between samples**, which are associated with variations in cellulose content,
- **Differences between points across same samples** which indicate that grainy structure of phantoms impacts measurements.

Comparison to the real construction wood samples shows:

- **Wood phantoms** have **similar peaks** to real wood samples.

Current research demonstrates potential for determining cellulose content in phantom samples. Due to the grainy structure of the material, additional measurements are needed to expand the dataset, ensure repeatable results, and capture underlying trends in order to obtain a **reliable reference model**.

## Conclusion

Wood phantoms show potential as a good reference material for wood spectroscopy.

### Advantages:

- Raman spectra exhibit **well-defined peaks** that can be easily identified.
- **Clear differences** in cellulose and lignin content are visible across samples.

### Challenges:

- Spectra from identical samples show variation due to the grainy, non-homogeneous structure of the phantoms.

### Next steps:

- Collect additional data to build a reliable machine learning model.
- Address the issue of structural non-homogeneity in the wood phantoms.

Overall, wood phantoms may be used in future research as a reference material.



## Acknowledgments

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