



Improved CTMP impregnation by the use of X-ray fluorescence measurements

OBJECTIVE

The environmental impact of plastic packaging is growing concern. Wood fiber-based materials could significantly reduce this problem. CTMP, a High Yield Pulp (HYP), would be a major component of sustainable packaging. In CTMP's rapid growth, sulfonation is overlooked. Sulfonation evenness is of critical importance, as the inner and outer parts of wood chips absorb different amounts of sulfite (SO_3^{2-}). Due to uneven sulfonation, more shives (unseparated fibers) are produced, which impairs the properties of the product. By utilizing frontier technology Polycapillary X-ray optics for energy-dispersed X-ray fluorescence (ED-XRF), we aim to measure CTMP fiber sulfonation to minimize SO_3^{2-} dosages and thereby reducing the total amount of electricity used in chip refining.

METHODS AND MATERIALS

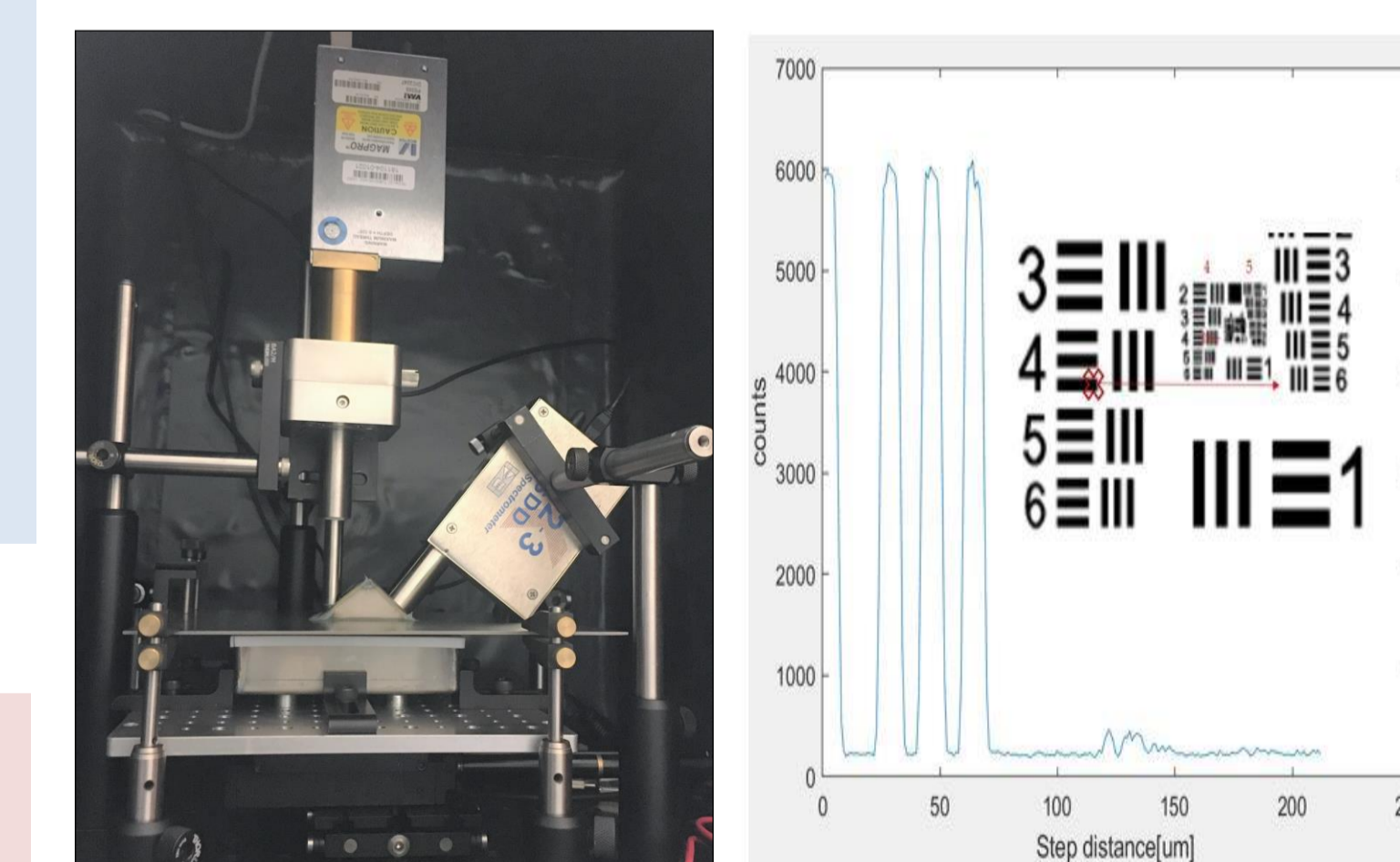
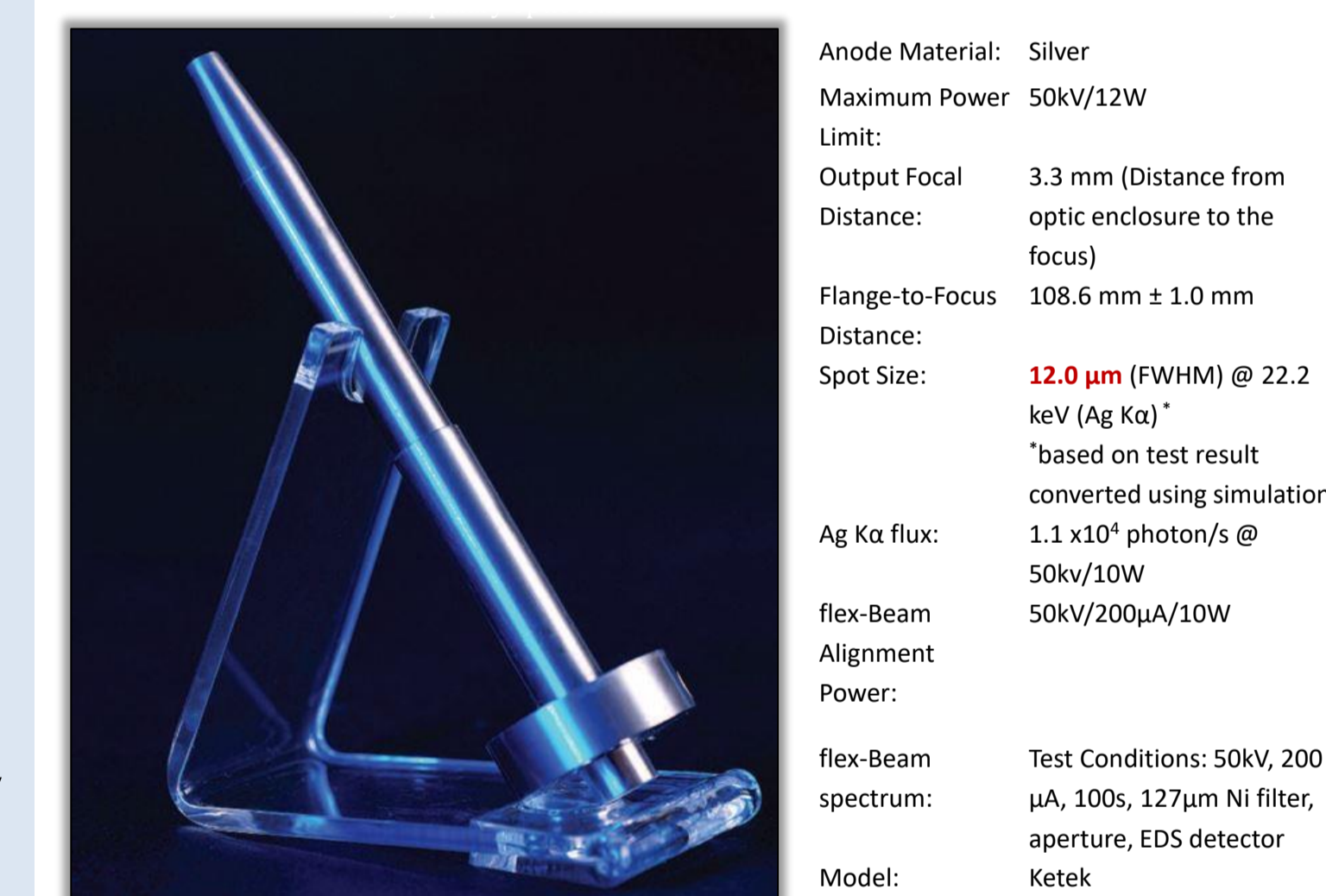
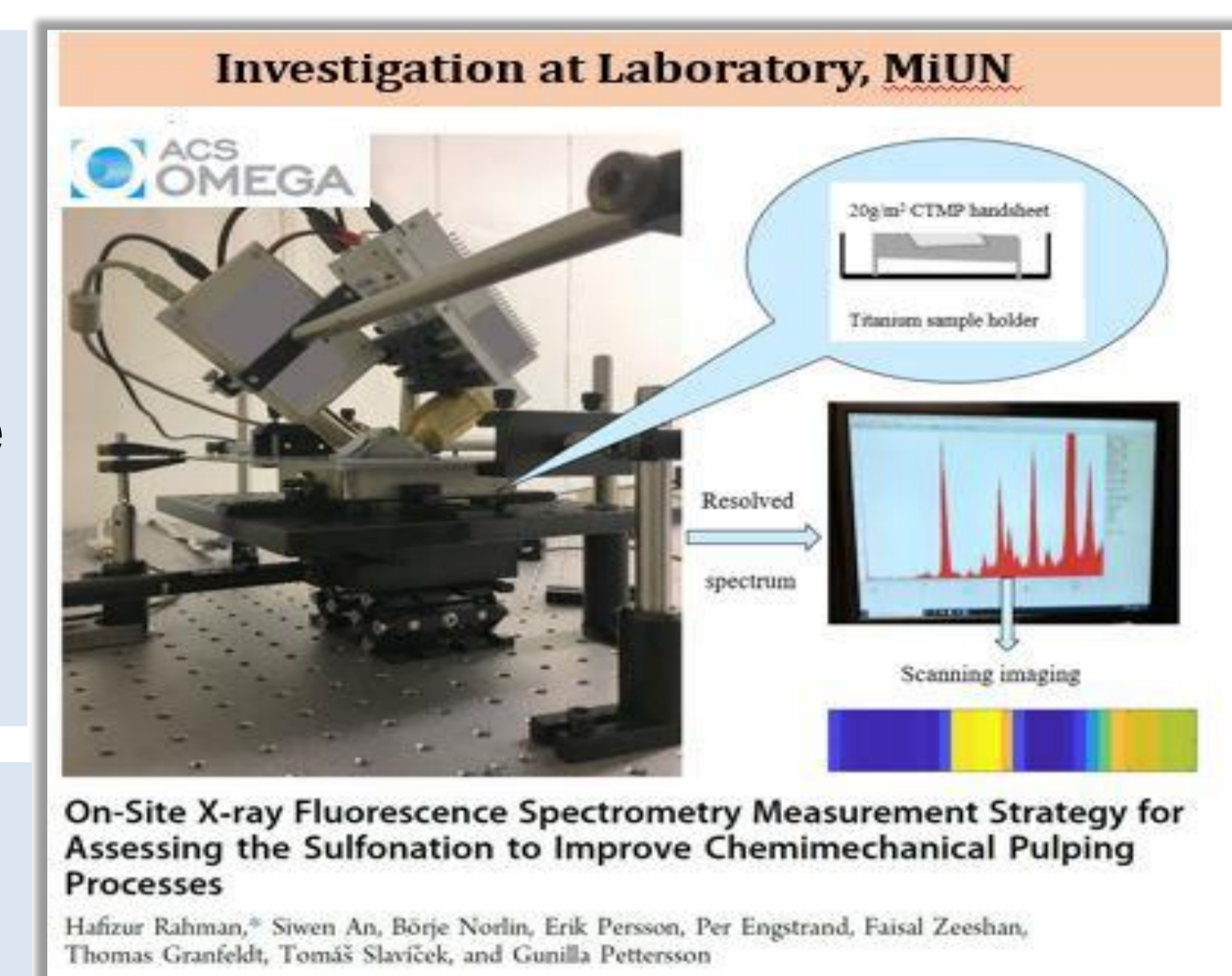
- A miniature ED-XRF polycapillary optic is setup at STC, MiUN, Sweden.
- Spatial measurements of Polycapillary optic (12 μm focal spot) are compared with the previous Moxtek (400 μm focal spot).
- A 20g/m² Billerud CTMP hand sheet is prepared at Valmet pilot plant.

RESULTS AND DISCUSSION

- This laboratory study validates the spectral resolution achieved in the Ti-shielded box, which enables the identification of sulfur [1,2].
- A significant difference was found in fiber sulfonate content [2].
- At next frontier technology, Polycapillary X-ray optics is more effective than previous 50 μm XRF pinholes [1]. It encapsulate between 10-20 μm for single fiber analysis.
- We present spatial resolution measurements and discuss the relevance and usability of the proposed measurement methodology to demonstrate its performance.
- We hypothesize that the efficiency and evenness of fiber separation in a chip refiner depend greatly on how evenly the chips have been sulfonated.

CONCLUSION

- The XRF measurement method can be used on-site to improve CTMP/CMP/HTCTMP impregnation technology and product properties.
- Process problems in advanced fiber materials can also be solved using it.
- For improving the uniformity of fiber properties, the XRF measurement can assist in optimizing process parameters to ensure even sulfonate distribution.



REFERENCES

1. Rahman, H. *et al*, (2022), ACS Omega 7(51), ss. 48555-48563.
2. Rahman, H. (2021), PhD Thesis, Mid Sweden University, Sweden, ISBN 978-91-89341-15-9.

