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Synchrotron macro ATR-FTIR: where we are and what's next for live-cell measurement

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Abstract

This presentation aims to provide a summary on the recent applications of our synchrotron macro ATR-FTIR microspectroscopy, unique to the Australian Synchrotron's Infrared Microspectroscopy (IRM) beamline. The technique provides molecular information with sub-cellular resolution down to 1-2 μm beyond the resolution limit allowed for standard synchrotron-FTIR setups and further simplifies otherwise complicated sample preparation [1]. Since the technique was made available for users in 2016, this high-resolution chemical mapping capability has facilitated diverse experiments on the beamline expanding its applications into many new areas. Some of the recent examples include novel environmental sustainable geopolymer concretes [2,3], archaeological bones [4] and spider silk cross-sections [5].

The second part of the presentation will highlight further development of the macro ATR-FTIR technique specifically for *live-cell* measurement in an aqueous environment. Through the collaboration with the SMIS beamline at SOLEIL (France), we undertook a beamtime experiment using their inverted ATR-FTIR accessory to acquire spectra from *live* red blood cells. The experience and knowledge gained from this international beamtime experiment, together with the effort from our mechanical engineering team, have resulted in an optical design to be developed into the first prototype of ATR-FTIR setup for *live-cell* measurement.

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References

- [1] J. Vongsvivut, D. Pérez-Guaita, B. R. Wood, P. Heraud, K. Khambatta, D. Hartnell, M. J. Hackett, and M. J. Tobin, "Synchrotron Macro ATR-FTIR Microspectroscopy for High-Resolution Chemical Mapping of Single Cells," *Analyst* **144**, 10, 3226-3238 (2019).
- [2] A. Hajimohammadi, T. Ngo, J. L. Provis, T. Kim, and J. Vongsvivut, "High Strength/Density Ratio in a Synthetic Foam Made from One-Part Mix Geopolymer and Cenospheres," *Composites Part B*, **173**, 106908 (2019).
- [3] A. Hajimohammadi, T. Ngo, and J. Vongsvivut, "Interfacial Chemistry of a Fly Ash Geopolymer and Aggregates," *Journal of Cleaner Production*, **231**, 980-989 (2019).
- [4] J. J. Miskiewicz, C. Rider, S. Kealy, C. Vrahnas, N. A. Sims, J. Vongsvivut, M. J. Tobin, M. J. L. A. Bolunia, A. S. De Leon, A. L. Peñalosa, P. S. Pagulayan, A. V. Soriano, R. Page, and M. F. Oxenham, "Asymmetric Midshaft Femur Remodelling in an Adult Male with Left Sided Hip Joint Ankylosis, Metal Period Nagsabaran, Philippines," *International Journal of Palaeopathology*, **31**, 14 (2020).
- [5] C. Haynl, J. Vongsvivut, K. R. H. Mayer, H. Bargel, V. J. Neubauer, M. J. Tobin, M. A. Elgar, and T. Scheibel, "Dimensional Stability of a Remarkable Spider Foraging Web Achieved by Synergistic Arrangement of Silk Fibers," accepted for publication in *Scientific Reports* (2020).

Primary author(s) : Dr VONGSVIVUT, Jitraporn (Pimm) (ANSTO - Australian Synchrotron)

Co-author(s) : Dr PÉREZ-GUAITA, David (FOCAS Research Institute); Ms NANKERVIS, Leah (ANSTO - Australian Synchrotron); Mr MASSEY, Adrian (ANSTO - Australian Synchrotron); Mr AMPT, Chris (ANSTO -

Australian Synchrotron); Mr MCKINLAY, Jonathan (ANSTO - Australian Synchrotron); Dr SANDT, Christophe (SMIS beamline, SOLEIL synchrotron); Dr TOBIN, Mark (ANSTO - Australian Synchrotron)

Presenter(s) : Dr VONGSVIVUT, Jitraporn (Pimm) (ANSTO - Australian Synchrotron)

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