



Contribution ID: 204

Type: Oral

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

Friday, 20 November 2020 15:55 (20 minutes)

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 geopolymers [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.

Acknowledgement

We would like to acknowledge the financial support from International Synchrotron Access Program (ISAP No. AS/IA182/14167) to perform the live-cell ATR-FTIR experiment at SOLEIL's SMIS beamline (Proposal ID. 20180157).

References

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Session Classification: Session 15 - Manufacturing, Engineering and Cultural Heritage

Track Classification: Manufacturing, Engineering and Cultural Heritage