TECHNOLOGY OFFER

WISSENS/
TRANSFER/
OST/

Rapid chiral analysis by IR laser based Vibrational Circular Dichroism (VCD)

QCL based Vibrational Circular Dichroism augmented by balanced detection employs a high power IR laser source for chiral analytics. This enables the collection of chiral information within a few minutes of measurement time, making chiral monitoring potentially feasible.

BACKGROUND

Enantiomers are molecules that have the same structure but cannot be superimposed on each other (like human hands). This property has serious implications for drug design, as different enantiomers of pharmaceutical active ingredients often have significant differences in their impact on the human body.
The correct identification of enantiomers of a given molecule is therefore crucial. Vibrational Circular Dichroism (VCD) is non-destructive spectroscopic technique that can identify enantiomers. However, a drawback of this technique is the long measurement time (up to several hours), preventing the routine use, the study of dynamic processes or the use in process analytical chemistry.

TECHNOLOGY

Our technology significantly improves the speed and sensitivity of VCD. It combines a quantum cascade laser (QCL) as a light source in a balanced detection scheme. Utilizing both the high brilliance and inherent polarization offered by the QCL, the technology improves the spectral throughput, simplifies the optical setup compared to the state of the art and enables the measurement of samples in highly absorbing solvents. However, compared to a thermal light source, QCLs add noise to the measurement system, reducing the possible gain in sensitivity. The balanced detection scheme deals with this problem by compensating the laser noise, while the chiral information accessible. Thus, the technology outperforms state-of-the-art VCD instruments in terms of noise levels by a factor of 3. Simultaneously it reduces the measurement time necessary for high quality VCD spectra to below 5 minutes. This significantly extends the field of applications for VCD, as dynamic processes and unstable systems can now also be studied.

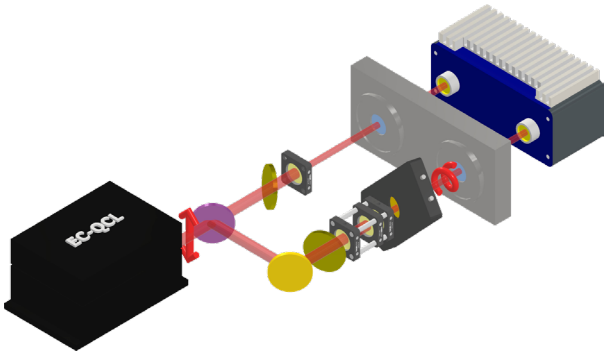

Figure 1: Schematic of the constructed optical setup.

ADVANTAGES

- Opportunity to study chiral biopolymers like proteins and nucleic acids in aqueous solutions, preserving their native state
- Low noise and increased sensitivity enable the study of analytically relevant concentration ranges, especially for small molecules in organic solvents
- Significantly higher sample throughput
- High time resolution permits monitoring approaches for chiral chemical processes
- Properties of QCL promise further possible gains in measurement time reduction

REFERENCE:
M048/2021

DEVELOPMENT STATUS:
Labscale prototype under progress
TRL = 3

APPLICATIONS:
Chiral analytics / Process control/ Structure elucidation / Enantiomeric excess monitoring

KEYWORDS:
Vibrational Circular Dichroism,
Quantum Cascade Laser
IR spectroscopy
Chirality

IPR:
AT patent pending

OPTIONS:
R&D cooperation,
Development partnership,
License agreement

INVENTORS:
HERMANN Daniel-Ralph
RAMER Georg
LENDL Bernhard

CONTACT:

Angelika Valenta
TU Wien
Research and Transfer Support
T: +43.1.58801.41538

www.rt.tuwien.ac.at

TU WIEN TECHNISCHE UNIVERSITÄT WIEN