Chair of Analytical Chemistry and Water Chemistry
TUM School of Natural Sciences
Technical University of Munich
Lichtenbergstraße 4
D-85748 Garching

Doctoral/PhD Position in Analytical Chemistry: Advancing Stable Isotope Analysis to Study the Mechanism of Heterogeneous Photocatalytic Systems

The Chair of Analytical Chemistry and Water Chemistry at the Technical University of Munich (TUM) is committed to excellence in research, teaching and interdisciplinary education. We strive to proactively develop analytical tools to detect health risks to humans and the environment, to better understand pollutant dynamics, and to achieve a **molecular-level understanding of complex systems**.

Project
A major challenge facing our society is moving away from fossil fuels and transitioning to a sustainable way of life. **Photocatalysis** is a technology with great potential to contribute to various fields, from the sustainable production of energy carriers to the degradation of persistent environmental pollutants and the development of more selective and environmentally friendly approaches in chemical synthesis.

Here, we will advance isotope effect measurements for a fundamental **understanding of reaction mechanisms in heterogeneous photocatalysis**. The focus will be on **Compound-specific Isotope Analysis (CSIA)** to achieve highly precise measurements of stable isotope ratios at natural abundance in organic substances, such as tertiary alcohols. Building on this, we will use kinetic isotope effects to identify rate-determining steps and competing reaction mechanisms. In collaboration with the Chair of Physical Chemistry we will **advance CSIA to mechanistically characterize photocatalytic reactions** under controlled conditions, with the ultimate goal to develop competitive materials for practical applications. After an initial training period, the successful candidate will:

- Conduct and plan photocatalytic experiments for isotope effect measurements
- Develop analytical protocols for dedicated target compounds
- Systematically vary reaction conditions to probe for isotope effects of different reaction steps
- Synthesize labelled substances in a complementary approach for mechanistic elucidation

The project includes opportunities to present results at international conferences and publish in leading journals. The candidate will further join the **TUM Graduate School** to access its unique infrastructure.

Qualifications
Applicants should hold an **above-average master's degree in chemistry,** and have a strong interest in experimental research. A willingness to learn new techniques and work across disciplines is essential, as is a **focus on mechanistic understanding, reaction kinetics, and analytical methods**. Candidates should have very good English communication skills, be able to work in an interdisciplinary environment, integrate into a team, and ideally have experience with **catalytic reaction systems, mass spectrometry, or gas chromatography**.

What we offer
At TUM, we offer a stimulating research environment at one of Europe's highest-ranked universities, with targeted training and individual supervision. The position is available immediately and fully funded, based on the Collective Agreement for the Civil Service of the Länder (67% TV-L E13). We are committed to **equal opportunities and value diversity**. We thus welcome applications from all individuals who feel addressed. TUM strives to raise the proportion of women in its workforce and encourages qualified women to apply. If equally qualified, severely disabled persons are preferred.

Application
Interested applicants shall send their **CV,** Master's and Bachelor's degree certificates and academic **Transcript of Records**, **a letter of motivation, and the names of possible references** to Prof. Martin Elsner (m.elsner@tum.de). See also https://www.ch.nat.tum.de/pc/research/e-conversion/ and https://www.ch.nat.tum.de/hydrochemistry/environmental-and-isotope-analysis/ for more information.