

The Application of Raman Spectroscopy for the Analysis of Heterogeneous Catalysts



Raman spectroscopy can be utilized for the analysis of catalysts and catalytic reactions in the chemical industry. It provides insights into catalyst composition, structure, and activity, helping optimise catalyst performance and understand reaction mechanisms. By monitoring catalyst deactivation or identifying catalyst poisons, Raman spectroscopy assists in maintaining catalyst efficiency and extending its lifespan.

7. Interpretation and Reporting

Interpret the results and draw conclusions about the catalyst's properties, performance, or potential improvements. Prepare a report.

6. Data Analysis

Analyse the acquired Raman spectra.



Peak Identification: Identify and assign Raman peaks.



Peak Fitting: Fit Raman peaks with mathematical functions for quantitative information (peak intensities, peak positions, peak widths) to determine the relative abundance of different species or the degree of catalyst activation.



Chemical Analysis: Analyse the catalyst's chemical composition.



Structural Analysis: Gain insights into the catalyst's structure.

1. Sample Preparation

Prepare the catalyst sample for analysis. Possible sample preparation techniques: grinding the catalyst to a fine powder, pelletizing or thin-film deposition.

2. Instrument Setup

Set up the Raman spectroscopy instrument according to the specific requirements of the catalyst analyst: laser wavelength, laser power, optimisation of the instrument parameters.

3. Baseline Correction

Acquire a baseline spectrum of the catalyst support material (e.g., alumina, silica).

4. Raman Measurement

Perform Raman measurements on the catalyst sample. Possible sampling techniques: placing the sample in a Raman microscope, using fiber optic probes, employing in situ Raman cells for catalysts under reaction conditions.

5. Data Acquisition

Collect Raman spectra from the catalyst sample of sufficient signal-to-noise ratio and appropriate integration time.

Conclusion

It is important to note that the specific methodology may vary depending on the type of catalyst, the research objectives, and the available equipment.

Adjustments and optimisations may be required based on the unique characteristics of the catalyst being analysed.

CHARISMA's contribution

The CHARISMA project is a European research initiative focused on advancing the application of Raman spectroscopy in various industries. The project aims to develop innovative techniques, methodologies, and equipment to enhance the efficiency and effectiveness of Raman spectroscopy in industrial processes. When considering the purchase of Raman equipment, it is valuable to stay informed about the latest developments and insights from the CHARISMA project, as it can provide valuable guidance and best practices for successful implementation.