

1. Record Nr.	UNINA9911020252503321
Autore	Tao Franklin
Titolo	Application of Ambient Pressure X-Ray Photoelectron Spectroscopy to Catalysis
Pubbl/distr/stampa	Newark : , : John Wiley & Sons, Incorporated, , 2023 ©2024
ISBN	9781119845485 1119845483 9781119845454 1119845459
Edizione	[1st ed.]
Descrizione fisica	1 online resource (286 pages)
Disciplina	543.62
Soggetti	X-ray photoelectron spectroscopy Catalysis
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di contenuto	Cover -- Title Page -- Copyright Page -- Contents -- Preface -- Chapter 1 From Surface of Model Catalyst in UHV to Surface of Nanoparticle Catalyst During Catalysis -- References -- Chapter 2 Application of XPS: from Surface in UHV to Surface in Gas or Liquid Phase -- 2.1 Origin of X-ray Photoelectron Spectroscopy -- 2.2 Applications of XPS to Study Surface in High Vacuum -- 2.3 Applications of XPS to Study Sample in Gas Phase -- 2.4 Applications of XPS to Study Sample in Liquid Phase -- 2.4.1 XPS Studies of Surface of Nanoparticle Catalyst in Static Liquid -- 2.4.2 XPS Studies of Surface of Nanoparticle Catalyst in Flowing Liquid -- 2.4.3 XPS Study of Flowing Gas with a Pressure of 1 atm or Higher -- References -- Chapter 3 Fundamentals of X-ray Photoelectron Spectroscopy -- 3.1 Principle of XPS -- 3.2 Generation of X-ray -- 3.3 Excitation of Photoelectron and Chemical Shift -- 3.3.1 Initial State Effect -- 3.3.2 Final State Effect -- 3.3.2.1 Core Hole-Induced Polarization Final State Effect -- 3.3.2.2 Core Hole-Induced Rearrangement Final State Effect -- 3.4 Measurements of Energy of Photoelectrons -- 3.5 Measurements of Intensity of Photoelectrons -- References -- Chapter 4

Instrumentation of XPS -- 4.1 Regular X-ray Source -- 4.2 X-ray Source with a Monochromator -- 4.3 Energy Analyzer -- 4.4 Detector --

References -- Chapter 5 Significance and Challenge of Studying Surface of a Catalyst in Gaseous Phase -- 5.1 Origin of Difference between Surface in UHV and Surface in Reactant Gas -- 5.2 Intrinsic Feature of Catalytic Sites on Surface: Environmental Sensitivity -- 5.3 Ex Situ, Semi-in Situ, and In Situ/Operando Studies of Catalyst Surface at Ambient Pressure of Reactants -- 5.3.1 Difference among Ex Situ, Semi-In Situ, and In Situ/Operando Studies.

5.3.2 Example of Surface Structures Only Formed and Maintained by Reactant at a Relatively High Pressure -- 5.3.3 Example of Catalyst Structure Only Observable during Catalysis -- 5.4 Ex Situ, Semi-in Situ, and In Situ/Operando Studies of Catalyst Structure at High Pressure -- 5.5 Technical Challenges in Studying Surface of a Catalyst in Gas Phase -- References -- Chapter 6 Instrumentation of Ambient Pressure X-ray Photoelectron Spectrometer -- 6.1 X-ray Source for AP-XPS Studies -- 6.1.1 Brief of X-ray Sources -- 6.1.2 Soft X-ray for AP-XPS and Its Limitation in High Pressure Studies -- 6.1.3 Al K for AP-XPS and Its Challenge in Working at Higher Pressure -- 6.1.4 Hard X-ray for AP-XPS and its Application to High Pressure Studies -- 6.2 Reaction Cell with Capability of Flowing Gas -- 6.2.1 Necessity of Having a Reaction Cell for Performing In Situ/Operando Studies of Catalysis -- 6.2.2 Structure of Reaction Cell -- 6.2.3 Sealing of a Reaction Cell and its Engaging Mechanism -- 6.2.4 Function of a Reaction Cell for AP-XPS Studies of Catalyst -- 6.3 Differential Pumping Energy Analyzer with High Transmission -- 6.4 Mass Spectrometer with Capability of Measurement of Catalytic Performance -- References -- Chapter 7 Experimental Methods of AP-XPS Studies -- 7.1 Leak Test of Reaction Cell -- 7.2 Exclusion of Catalysis by Reaction Cell -- 7.3 Tuning and Control of Sample-Aperture Distance -- 7.4 Sample Heating and Temperature Control -- 7.5 Online Measurement of Reactants and Products -- 7.6 Spectroscopic Titration of Surface Species -- References -- Chapter 8 Difference in Data Analysis Between AP-XPS and High Vacuum XPS -- 8.1 Potential Difference in Measuring Atomic Ratio of Two Elements on Catalyst Surface -- 8.2 Difference in Intensity of Photoelectrons Collected by Energy Analyzer -- 8.3 Difference in Resolution and Baseline of Spectrum.

8.4 Difference in Spectrum between Free Molecules in Gas and Adsorbed Molecules on Surface -- 8.5 Calibration of Nominal Atomic Ratio A/Z of a Catalyst Surface in a Pure Gas -- 8.6 Calibration of Nominal Atomic Ratio A/Z of a Catalyst Surface in a Mixture of Reactants -- 8.7 Calibration of Nominal Atomic Ratio A/Z of a Catalyst Surface in a Pure Gas Obtained at Different Temperature for Fair Comparison -- References -- Chapter 9 Significance of Using AP-XPS in Studies of Catalysis -- 9.1 Fundamental of Catalyst Surface -- 9.2 Significance of Characterization of Surface of a Catalyst in Gas Phase -- 9.3 Significance of Using AP-XPS in Fundamental Studies of Catalysis -- References -- Chapter 10 CO Oxidation on Single Crystal Model Catalysts -- 10.1 Pt(557) and Pt(332) in CO -- 10.2 CO Oxidation on Pd(100), Pd(111), and Pd(110) -- 10.2.1 CO Oxidation on Pd(100) -- 10.2.2 CO Oxidation on Pd(111) -- 10.2.3 CO Oxidation on Pd(110) -- 10.3 CO Oxidation on Pt(110) and Pt(111) -- 10.3.1 CO Oxidation on Pt(110) -- 10.3.2 CO Oxidation on Pt(111) -- 10.4 CO Oxidation on Rh(110) -- 10.5 CO Oxidation on Cu(111) -- References -- Chapter 11 CO Oxidation on High Surface Area Catalysts -- 11.1 CO Oxidation on Rh Nanoparticles -- 11.2 CO Oxidation on Ru Nanoparticles -- References -- Chapter 12 Hydrogenation of Carbon Dioxide -- References -- Chapter 13 Water-Gas Shift -- 13.1 Co₃O₄

and Pt/Co₃O₄ -- 13.1.1 Gas Composition-dependent Reducibility -- 13.1.2 Active Phase of Co₃O₄ during Water-Gas Shift -- 13.1.3 Active Phase of 0.5 wt% Pt/Co₃O₄ at 150-200 °C -- 13.1.4 Active Phase of 0.5 wt% Pt/Co₃O₄ at 280-350 °C -- 13.1.5 Temperature-dependent Evolution of Active Phase -- 13.2 Pt, Au, Pd, and Cu Supported on CeO₂ Nanorods -- 13.3 CuOCr₂O₃Fe₂O₃ -- References -- Chapter 14 Complete Oxidation of Methane -- 14.1 Complete Oxidation of Methane on NiCo₂O₄.
14.2 Complete Oxidation of Methane on NiFe₂O₄ -- 14.3 Complete Oxidation of Methane on NiO with Different Surface Structures -- References -- Chapter 15 Partial Oxidation of Methanol -- 15.1 Partial Oxidation of Methanol on Pd₁Zn₃/ZnO -- 15.2 Partial Oxidation of Methanol on Ir₁Zn₃/ZnO -- References -- Chapter 16 Partial Oxidation of Methane -- 16.1 Partial Oxidation of Methane on Pd/CeO₂ -- 16.2 Partial Oxidation of Methane on Pt/CeO₂ -- 16.3 Partial Oxidation of Methane on Rh/CeO₂ -- References -- Chapter 17 Oxidative Coupling of Methane -- 17.1 OCM on Supported Na₂WO₄ and Hypothesized Active Phase Na₂O₂ -- 17.2 First Observation of Na₂O₂ through AP-XPS Studies at 800 °C -- 17.3 Formation of a Thin Layer of Na₂O₂ Supported on Na₂WO₄ -- References -- Chapter 18 Dry and Steam Reforming of Methane -- 18.1 Dry Reforming of CH₄ on CeO₂ Anchored with Ni₁ and Ru₁ Sites -- 18.2 Steam Reforming of CH₄ on CeO₂ Anchored with Ni₁ and Ru₁ Single-atom Sites -- References -- Chapter 19 Reduction of NO with CO -- 19.1 Reduction of NO with CO on Co₃O₄ -- 19.2 Reduction of NO with CO on Rh₁Co₃ Clusters Supported on CoO -- References -- Chapter 20 Tuning Catalyst Surfaces for Developing Catalysts -- 20.1 Capability of Compositional Restructuring Checkable with AP-XPS -- 20.2 Tracking Restructuring of Bimetallic Surface under Reaction and Catalytic Conditions for Tuning Catalytic Performance of a Bimetallic Catalyst -- References -- Chapter 21 Photocatalysis -- References -- Index -- EULA.

Sommario/riassunto

This book, authored by Franklin Tao, explores the application of Ambient Pressure X-ray Photoelectron Spectroscopy (AP-XPS) in the study of catalysts. It delves into the principles and techniques of XPS, highlighting its significance in analyzing catalyst surfaces under various environmental conditions, including gaseous phases. The text discusses the challenges and methodologies involved in studying catalytic reactions and offers insights into the technical aspects of AP-XPS, such as energy analysis and reaction cell design. Intended for researchers and professionals in chemical engineering and catalysis, the book provides an in-depth examination of surface phenomena and the role of AP-XPS in advancing the understanding of catalytic processes.
