

Principles Amp Practice Of Heterogeneous Catalysis

[#heterogeneous catalysis](#) [#catalysis principles](#) [#catalysis practice](#) [#catalyst design](#) [#industrial catalysis](#)

Explore the foundational principles and practical applications of heterogeneous catalysis through this comprehensive resource. Delve into essential concepts, catalyst design strategies, and the methodologies defining catalysis practice across various industries. This guide is ideal for understanding the mechanisms and engineering aspects crucial for industrial catalysis and optimizing catalytic processes.

We ensure every note maintains academic accuracy and practical relevance.

Thank you for visiting our website.

We are pleased to inform you that the document Practice Heterogeneous Catalysis you are looking for is available here.

Please feel free to download it for free and enjoy easy access.

This document is authentic and verified from the original source.

We always strive to provide reliable references for our valued visitors.

That way, you can use it without any concern about its authenticity.

We hope this document is useful for your needs.

Keep visiting our website for more helpful resources.

Thank you for your trust in our service.

This document is one of the most sought-after resources in digital libraries across the internet.

You are fortunate to have found it here.

We provide you with the full version of Practice Heterogeneous Catalysis completely free of charge.

Principles and Practice of Heterogeneous Catalysis

This long-awaited second edition of the successful introduction to the fundamentals of heterogeneous catalysis is now completely revised and updated. Written by internationally acclaimed experts, this textbook includes fundamentals of adsorption, characterizing catalysts and their surfaces, the significance of pore structure and surface area, solid-state and surface chemistry, poisoning, promotion, deactivation and selectivity of catalysts, as well as catalytic process engineering. A final section provides a number of examples and case histories. With its color and numerous graphics plus references to help readers to easily find further reading, this is a pivotal work for an understanding of the principles involved.

Principles and Practice of Heterogeneous Catalysis

Catalysis occupies a pivotal position in the physical and biological sciences. As well as being the mainstay of the chemical industry, it is the means of effecting many laboratory syntheses and the root cause of all enzymatic processes. This book is an eminently readable introduction to the fundamental principles of heterogeneous catalysis. Written by world-renowned experts, it explains the vocabulary, grammar and literature of catalysis from the laboratory-oriented model study through to the operating plant. Didactically skillful and using many lucidly designed figures, the authors present an insightful exposition of all important concepts, new developments and techniques in this rapidly advancing field.

Introduction to the Principles of Heterogeneous Catalysis

Successful industrial heterogeneous catalysts fulfill several key requirements: in addition to high catalytic activity for the desired reaction, with high selectivity where appropriate, they also have an acceptable commercial life and are rugged enough for transportation and charging into plant reactors. Additional requirements include the need to come online smoothly in a short time and reproducible

manufacturing procedures that involve convenient processes at acceptable cost. The development of heterogeneous catalysts that meet these (often mutually exclusive) demands is far from straightforward, and in addition much of the actual manufacturing technology is kept secret for commercial reasons-thus there is no modern text that deals with the whole of this important subject. Principles of Catalyst Development, which deals comprehensively with the design, development, and manufacture of practical heterogeneous catalysts, is therefore especially valuable in meeting the long-standing needs of both industrialists and academics. As one who has worked extensively on a variety of catalyst development problems in both industry and academia, James T. Richardson is well placed to write an authoritative book covering both the theory and the practice of catalyst development. Much of the material contained in this book had its origin in a series of widely acclaimed lectures, attended mainly by industrial researchers, given over many years in the United States and Europe. All those in industry who work with catalysts, both beginners and those of considerable experience, should find this volume an essential guide.

Heterogeneous Catalysis

This book is based on a graduate course and suitable as a primer for any newcomer to the field, this book is a detailed introduction to the experimental and computational methods that are used to study how solid surfaces act as catalysts. Features include: First comprehensive description of modern theory of heterogeneous catalysis Basis for understanding and designing experiments in the field Allows reader to understand catalyst design principles Introduction to important elements of energy transformation technology Test driven at Stanford University over several semesters

Principles of Catalyst Development

Catalysis is a multidisciplinary subject. This book introduces the chemical, materials, and engineering principles of catalysis so that both MSc and PhD students with a basic but not extensive knowledge of chemistry and physics and those with a basic understanding of chemical engineering can learn more about catalysis. Examples are taken from catalytic reactions and catalysts used in the energy, petroleum, and base-chemicals industry. The second edition differs from the first edition in the way basic topics are integrated with catalytic applications. The authors introduce two new chapters: 'Cleaning of Fuels by Hydrotreating' and 'Electrocatalysis'. Hydrotreating is a very important industrial process and offers the opportunity to discuss metal sulfide catalysts. Electrocatalysis gains more and more attention because it can be used to minimize the anthropogenic CO₂ emissions. Solar, wind, and hydroelectricity can drive water electrolysis and CO₂ electroreduction and, therefore, excess renewable electricity can be stored in chemicals. Introduction to Heterogeneous Catalysis (Second Edition) is intended for a one-semester course for master and PhD students who want to learn more about the principles of catalysis. This must-read textbook will enable students to read catalysis literature without much difficulty and presents not only the basic concepts of catalysis but integrates the chemical, materials, and engineering aspects of catalysis with industry examples.

Heterogeneous Catalysis

Catalysis literature can be difficult to read if there is not a sufficient understanding of the underlying connections between the chemical, materials and engineering aspects of catalysis. As a result, many students lack the depth of knowledge to effectively understand the topic. Introduction to Heterogeneous Catalysis solves this issue by presenting not only the basic concepts of catalysis but also, right from the beginning, integrating the chemical, materials and engineering aspects of catalysis in examples taken directly from industry. Aimed at master's and PhD students with a limited background in chemistry, this book provides a thorough introduction to the principles behind catalysis that will enable readers to understand the concepts and analyse the literature necessary for its study.

Fundamental Concepts in Heterogeneous Catalysis

Blending theory and practice, this text provides the information needed to work with solid catalysts in the laboratory, pilot plant or commercial installation. This revised and expanded edition incorporates recent theories and industrial applications.

Introduction To Heterogeneous Catalysis (Second Edition)

Heterogeneous catalysis has developed over the past two centuries as a technology driven by the needs of society, and is part of Nobel Prize-winning science. This book describes the spectacular increase in molecular understanding of heterogeneous catalytic reactions in important industrial processes. Reaction mechanism and kinetics are discussed with a unique focus on their relation with the inorganic chemistry of the catalyst material. An introductory chapter presents the development of catalysis science and catalyst discovery from a historical perspective. Five chapters that form the thrust of the book are organized by type of reaction, reactivity principles, and mechanistic theories, which provide the scientific basis to structure-function relationships of catalyst performance. Present-day challenges to catalysis are sketched in a final chapter. Written by one of the world's leading experts on the topic, this definitive text is an essential reference for students, researchers and engineers working in this multibillion-dollar field.

Heterogeneous Catalysis in Practice

High throughput experimentation has met great success in drug design but it has, so far, been scarcely used in the field of catalysis. We present in this book the outcome of a NATO ASI meeting that was held in Vilamoura, Portugal, between July 15 and 28, 2001, with the objective of delineating and consolidating the principles and methods underpinning accelerated catalyst design, evaluation, and development. There is a need to make the underlying principles of this new methodology more widely understood and to make it available in a coherent and integrated format. The latter objective is particularly important to the young scientists who will constitute the new catalysis researchers generation. Indeed, this field which is at the frontier of fundamental science and may be a renaissance for catalysis, is one which is much more complex than classical catalysis itself. It implies a close collaboration between scientists from many disciplines (chemistry, physics, chemical and mechanical engineering, automation, robotics, and scientific computing in general). In addition, this emerging area of science is also of paramount industrial importance, as progress in this area would collapse the time necessary to discover new catalysts or improve existing ones.

Introduction to Heterogeneous Catalysis

Heterogeneous catalysis plays a part in the production of more than 80% of all chemical products. It is therefore essential that all chemists and chemical engineers have an understanding of the fundamental principles as well as the applications of heterogeneous catalysts. This book introduces the subject, starting at a basic level, and includes sections on adsorption and surface science, catalytic kinetics, experimental methods for preparing and studying heterogeneous catalysts, as well as some aspects of the design of industrial catalytic reactors. It ends with a chapter that covers a range of examples of important catalytic processes. The book leads the student to carrying out a series of "tasks" based on searches of the internet and also on the use of web-based search tools such as Scopus or Web of Science. These tasks are generally based on the text; they can be used entirely for self-study but they can also be tailored to the requirements of a particular course by the instructor/lecturer giving the course. The author has had over 40 years of experience in catalytic research as well as in lecturing on the principles of catalysis. He was for more than 20 years the Editor of *Catalysis Today*. Coverage of all aspects of catalysis in carefully organised text. Inclusion of material on the historical development of the subject and the personalities involved. All concepts illustrated by practical examples. Inclusion of a wide range of problems and solutions, case studies, and supplementary web based material which will be regularly updated. Author has over 40 years research experience of almost all covered subjects. Provides companion materials website.

Heterogeneous Catalysis in Industrial Practice

Fundamentals along with modern aspects of catalysis including spectroscopic methods are covered in this valuable text.

Mechanisms In Heterogeneous Catalysis

This book is an excellent compilation of cutting-edge research in heterogeneous catalysis and related disciplines – surface science, organometallic catalysis, and enzymatic catalysis. In 23 chapters by noted experts, the volume demonstrates varied approaches using model systems and their successes in understanding aspects of heterogeneous catalysis, both metal- and metal oxide-based catalysis in extended single crystal and nanostructured catalytic materials. To truly appreciate the astounding advances of modern heterogeneous catalysis, let us first consider the subject from a historical

perspective. Heterogeneous catalysis had its beginnings in England and France with the work of scientists such as Humphrey Davy (1778–1829), Michael Faraday (1791–1867), and Paul Sabatier (1854–1941). Sabatier postulated that surface compounds, similar to those familiar in bulk to chemists, were the intermediate species leading to catalytic products. Sabatier proposed, for example, that NiH moieties on a Ni surface were able to hydrogenate ethylene, whereas NiH was not. In the USA, Irving Langmuir concluded just the opposite, namely, that chemisorbed surface species are chemically bound to surfaces and are unlike known molecules. These chemisorbed species were the active participants in catalysis. The equilibrium between gas-phase molecules and adsorbed chemisorbed species (yielding an adsorption isotherm) produced a monolayer by simple site-filling kinetics.

Principles and Methods for Accelerated Catalyst Design and Testing

Helps researchers develop new catalysts for sustainable fuel and chemical production Reviewing the latest developments in the field, this book explores the in-situ characterization of heterogeneous catalysts, enabling readers to take full advantage of the sophisticated techniques used to study heterogeneous catalysts and reaction mechanisms. In using these techniques, readers can learn to improve the selectivity and the performance of catalysts and how to prepare catalysts as efficiently as possible, with minimum waste. In-situ Characterization of Heterogeneous Catalysts features contributions from leading experts in the field of catalysis. It begins with an introduction to the fundamentals and then covers: Characterization of electronic and structural properties of catalysts using X-ray absorption fine structure spectroscopy Techniques for structural characterization based on X-ray diffraction, neutron scattering, and pair distribution function analysis Microscopy and morphological studies Techniques for studying the interaction of adsorbates with catalyst surfaces, including infrared spectroscopy, Raman spectroscopy, EPR, and moderate pressure XPS Integration of techniques that provide information on the structural properties of catalysts with techniques that facilitate the study of surface reactions Throughout the book, detailed examples illustrate how techniques for studying catalysts and reaction mechanisms can be applied to solve a broad range of problems in heterogeneous catalysis. Detailed figures help readers better understand how and why the techniques discussed in the book work. At the end of each chapter, an extensive set of references leads to the primary literature in the field. By explaining step by step modern techniques for the in-situ characterization of heterogeneous catalysts, this book enables chemical scientists and engineers to better understand catalyst behavior and design new catalysts for green, sustainable fuel and chemical production.

Heterogeneous Catalysis

Selective Oxidation by Heterogeneous Catalysis covers one of the major areas of industrial petrochemical production, outlining open questions and new opportunities. It gives keys for the interpretation and analysis of data and design of new catalysts and reactions, and provides guidelines for future research. A distinctive feature of this book is the use of concept by example. Rather than reporting an overview of the literature results, the authors have selected some representative examples, the in-depth analysis of which makes it possible to clarify the fundamental, but new concepts necessary for a better understanding of the new opportunities in this field and the design of new catalysts or catalytic reactions. Attention is given not only to the catalyst itself, but also to the use of the catalyst inside the process, thus evidencing the relationship between catalyst design and engineering aspects of the process. This book provides suggestions for new innovative directions of research and indications on how to reconsider the field of selective oxidation from different perspectives, outlining that is not a mature field of research, but that new important breakthroughs can be derived from fundamental and applied research. Suggestions are offered on how to use less conventional approaches in terms of both catalyst design and analysis of the data.

Introduction to the Principles of Heterogeneous Catalysis

Presents state-of-the-art knowledge of heterogeneous catalysts including new applications in energy and environmental fields This book focuses on emerging techniques in heterogeneous catalysis, from new methodology for catalysts design and synthesis, surface studies and operando spectroscopies, ab initio techniques, to critical catalytic systems as relevant to energy and the environment. It provides the vision of addressing the foreseeable knowledge gap unfilled by classical knowledge in the field. Heterogeneous Catalysts: Advanced Design, Characterization and Applications begins with an overview on the evolution in catalysts synthesis and introduces readers to facets engineering on catalysts; electrochemical synthesis of nanostructured catalytic thin films; and bandgap engineering

of semiconductor photocatalysts. Next, it examines how we are gaining a more precise understanding of catalytic events and materials under working conditions. It covers bridging pressure gap in surface catalytic studies; tomography in catalysts design; and resolving catalyst performance at nanoscale via fluorescence microscopy. Quantum approaches to predicting molecular reactions on catalytic surfaces follows that, along with chapters on Density Functional Theory in heterogeneous catalysis; first principles simulation of electrified interfaces in electrochemistry; and high-throughput computational design of novel catalytic materials. The book also discusses embracing the energy and environmental challenges of the 21st century through heterogeneous catalysis and much more. Presents recent developments in heterogeneous catalysis with emphasis on new fundamentals and emerging techniques Offers a comprehensive look at the important aspects of heterogeneous catalysis Provides an applications-oriented, bottoms-up approach to a high-interest subject that plays a vital role in industry and is widely applied in areas related to energy and environment Heterogeneous Catalysts: Advanced Design, Characterization and Applications is an important book for catalytic chemists, materials scientists, surface chemists, physical chemists, inorganic chemists, chemical engineers, and other professionals working in the chemical industry.

Catalysis

"Catalysis is a multidisciplinary subject. This book introduces the chemical, materials, and engineering principles of catalysis so that both MSc and PhD students with a basic but not extensive knowledge of chemistry and physics and those with a basic understanding of chemical engineering can learn more about catalysis. Examples are taken from catalytic reactions and catalysts used in the energy, petroleum, and base-chemicals industry. The second edition differs from the first edition in the way basic topics are integrated with catalytic applications. The authors introduce two new chapters: 'Cleaning of Fuels by Hydrotreating' and 'Electrocatalysis.' Hydrotreating is a very important industrial process and offers the opportunity to discuss metal sulfide catalysts. Electrocatalysis gains more and more attention because it can be used to minimize the anthropogenic CO₂ emissions. Solar, wind, and hydroelectricity can drive water electrolysis and CO₂ electroreduction and, therefore, excess renewable electricity can be stored in chemicals. Introduction to Heterogeneous Catalysis (Second Edition) is intended for a one-semester course for master and PhD students who want to learn more about the principles of catalysis. This must-read textbook will enable students to read catalysis literature without much difficulty and presents not only the basic concepts of catalysis but integrates the chemical, materials, and engineering aspects of catalysis with industry examples"--

Heterogeneous Catalysis in Practice

Heterogeneous catalysis plays a part in the production of more than 80% of all chemical products. It is therefore essential that all chemists and chemical engineers have an understanding of the fundamental principles as well as the applications of heterogeneous catalysts. This book introduces the subject, starting at a basic level, and includes sections on adsorption and surface science, catalytic kinetics, experimental methods for preparing and studying heterogeneous catalysts, as well as some aspects of the design of industrial catalytic reactors. It ends with a chapter that covers a range of examples of important catalytic processes. The book leads the student to carrying out a series of "tasks" based on searches of the internet and also on the use of web-based search tools such as Scopus or Web of Science. These tasks are generally based on the text; they can be used entirely for self-study but they can also be tailored to the requirements of a particular course by the instructor/lecturer giving the course. The author has had over 40 years of experience in catalytic research as well as in lecturing on the principles of catalysis. He was for more than 20 years the Editor of Catalysis Today. Coverage of all aspects of catalysis in carefully organised text Inclusion of material on the historical development of the subject and the personalities involved All concepts illustrated by practical examples Inclusion of a wide range of problems and solutions, case studies, and supplementary web based material which will be regularly updated Author has over 40 years research experience of almost all covered subjects Provides companion materials webiste

Model Systems in Catalysis

Sets the stage for environmentally friendly industrial organic syntheses From basic principles to new and emerging industrial applications, this book offers comprehensive coverage of heterogeneous liquid-phase selective oxidation catalysis. It fully examines the synthesis, characterization, and application of catalytic materials for environmentally friendly organic syntheses. Readers will find coverage of all

the important classes of catalysts, with an emphasis on their stability and reusability. Liquid Phase Oxidation via Heterogeneous Catalysis features contributions from an international team of leading chemists representing both industry and academia. The book begins with a chapter on environmentally benign oxidants and then covers: Selective oxidations catalyzed by TS-1 and other metal-substituted zeolites Selective catalytic oxidation over ordered nanoporous metallo-aluminophosphates Selective oxidations catalyzed by mesoporous metal-silicates Liquid phase oxidation of organic compounds by supported metal-based catalysts Selective liquid phase oxidations in the presence of supported polyoxometalates Selective oxidations catalyzed by supported metal complexes Liquid phase oxidation of organic compounds by metal-organic frameworks Heterogeneous photocatalysis for selective oxidations with molecular oxygen All the chapters dedicated to specific types of catalysts follow a similar organization and structure, making it easy to compare the advantages and disadvantages of different catalysts. The final chapter examines the latest industrial applications, such as the production of catechol and hydroquinone, cyclohexanone oxime, and propylene oxide. With its unique focus on liquid phase heterogeneous oxidation catalysis, this book enables researchers in organic synthesis and oxidation catalysis to explore and develop promising new catalytic materials and synthetic routes for a broad range of industrial applications.

In-situ Characterization of Heterogeneous Catalysts

Provides a clear and systematic description of the key role played by catalyst reactant dynamism including: (i) the fundamental processes at work, (ii) the origin of its general and physical features, (iii) the way it has evolved, and (iv) how it relates to catalysis in man-made systems. Unifies homogeneous, heterogeneous, and enzymatic catalysis into a single, conceptually coherent whole. Describes how to authentically mimic the underlying principles of enzymatic catalysis in man-made systems. Examines the origin and role of complexity and complex Systems Science in catalysis--very hot topics in science today.

Selective Oxidation by Heterogeneous Catalysis

This book is an excellent compilation of cutting-edge research in heterogeneous catalysis and related disciplines – surface science, organometallic catalysis, and enzymatic catalysis. In 23 chapters by noted experts, the volume demonstrates varied approaches using model systems and their successes in understanding aspects of heterogeneous catalysis, both metal- and metal oxide-based catalysis in extended single crystal and nanostructured catalytic materials. To truly appreciate the astounding advances of modern heterogeneous catalysis, let us first consider the subject from a historical perspective. Heterogeneous catalysis had its beginnings in England and France with the work of scientists such as Humphrey Davy (1778–1829), Michael Faraday (1791–1867), and Paul Sabatier (1854–1941). Sabatier postulated that surface compounds, similar to those familiar in bulk to chemists, were the intermediate species leading to catalytic products. Sabatier proposed, for example, that NiH moieties on a Ni surface were able to hydrogenate ethylene, whereas NiH was not. In the USA, Irving Langmuir concluded just the opposite, namely, that chemisorbed surface species are chemically bound to surfaces and are unlike known molecules. These chemisorbed species were the active participants in catalysis. The equilibrium between gas-phase molecules and adsorbed chemisorbed species (yielding an adsorption isotherm) produced a monolayer by simple site-filling kinetics.

Heterogeneous Catalysts

This textbook is a perfect introduction to heterogeneous catalysis focusing on the industrial implementation. It is written in a comprehensible manner using language that is easy accessible and provides problems to practice. Fundamentals such as adsorption, kinetics, transport effects and catalytic reactors as well as applications in current topics such as Green Chemistry, Nanotechnology and microreactor engineering are summarized.

Basic Principles in Applied Catalysis

The design of improved heterogeneous catalysts requires a detailed understanding of the governing surface chemistry. Significant advances over the past two decades in electronic structure calculation algorithms and high performance computing have made theoretical tools indispensable in the quest to understand catalysis at the atomic scale. In this dissertation, first principles electronic structure calculations based on density functional theory (DFT) and microkinetic modeling are combined with experimental studies, including surface science, electrocatalysis and reaction kinetics, to elucidate

reaction mechanisms and design improved catalysts for a variety of reactions important to energy and environmental applications. Chapters 3 and 4 of this dissertation focus on the fundamental end of the catalysis research spectrum. In this work, experimental surface science studies, using high-resolution, high-speed scanning tunneling microscopy are combined with periodic, self-consistent DFT calculations to improve our understanding of two important processes, hydrogen diffusion and water adsorption, on a metal oxide thin film. In Chapter 5, first principles calculations are utilized to study the vapor phase reaction between hydrogen and oxygen on a homogeneous bimetallic PdAg alloy surface. A successful example of catalyst design for an electrocatalytic application is demonstrated in Chapter 6 using a combined theoretical and experimental approach. A core-shell alloy, composed of an Ir-Re core and Pt and Pd shell layers, is shown to be an effective low cost electrocatalyst for the oxygen reduction reaction. Finally, in Chapters 7 and 8 of this dissertation, DFT calculations are combined with experimental reaction kinetic studies using a microkinetic model to bridge the pressure and materials gap, in a study of nitric oxide reduction by hydrogen on a platinum catalyst. In this work, we show the impact of nitric oxide surface coverage on the reaction energetics and elucidate the reaction pathways governing the activity and selectivity of the reaction on Pt under realistic reaction conditions.

Introduction to Heterogeneous Catalysis

Heterogeneous catalysts are now widely applied in everyday life, this book is an important source of information regarding the fundamentals and applications of catalysis, aimed at the undergraduate level.

Heterogeneous Catalysis

For far too long chemists and industrialists have relied on the use of aggressive reagents such as nitric and sulphuric acids, permanganates and dichromates to prepare the massive quantities of both bulk and fine chemicals that are needed for the maintenance of civilised life — materials such as fuels, fabrics, foodstuffs, fertilisers and pharmaceuticals. Such aggressive reagents generate vast quantities of environmentally harmful and often toxic by-products, including the oxides of nitrogen, of metal oxides and carbon dioxide. Now, owing to recent advances made in the synthesis of nanoporous solids, it is feasible to design new solid catalysts that enable benign, mild oxidants to be used, frequently without utilising solvents, to manufacture the products that the chemical, pharmaceutical, agro- and bio-chemical industries require. These new solid agents are designated single-site heterogeneous catalysts (SSHCs). Their principal characteristics are that all the active sites present in the high-area solids are identical in their atomic environment and hence in their energy of interaction with reactants, just as in enzymes. Single-site heterogeneous catalysts now occupy a position of growing importance both academically and in their potential for commercial exploitation. This text, the only one devoted to such catalysts, dwells both on principles of design and on applications, such as the benign synthesis of nylon 6 and vitamin B3. It equips the reader with unifying insights required for future catalytic adventures in the quest for sustainability in the materials used by humankind. Anyone acquainted with the language of molecules, including undergraduates in the physical and biological sciences, as well as graduates in engineering and materials science, should be able to assimilate the principles and examples presented in this book. Inter alia, it describes how clean technology and 'green' processes may be carried out in an environmentally responsible manner.

Liquid Phase Oxidation via Heterogeneous Catalysis

This book consists of lectures presented by international authorities in the field, at a course on Oxidation Catalysis organized by the Dutch Research School in Catalysis at Rolduc in June 1994.

Mechanical Catalysis

Established as the foremost text in the field, *Principles and Practice of Endocrinology and Metabolism* is now in its thoroughly revised, updated Third Edition. This practical, clinically relevant, and comprehensive text covers the entire field of endocrinology and metabolism, including the diffuse endocrine system; morphology and physiology; diagnosis and treatment of endocrine diseases; endocrinology of the female; hormones and cancer; and much more. The Third Edition contains new chapters reflecting the latest advances and features expanded coverage of genetics and the endocrinology of sepsis. More than 1,400 illustrations complement the text. A drug formulary appears at the back of the book.

Model Systems in Catalysis

