

Fullerenes

Fullerenes are considered by IUPAC as compounds composed solely of an even number of carbon atoms, which form a cage-like fused-ring polycyclic system with twelve five-membered rings and the rest six-membered rings. The archetypal example is [60]fullerene, where the atoms and bonds delineate a truncated icosahedron. The term has been broadened to include any closed cage structure consisting entirely of three-coordinate carbon atoms (This definition is from the following source: PAC, 1995, 67, 1307 (Glossary of class names of organic compounds and reactivity intermediates based on structure (IUPAC Recommendations 1995)) on page 1336).



Common Names:

[60]fullerene
Fullerene- C_{60}
(C_{60} - I_h)[5,6]fullerene
Buckminsterfullerene
Buckyball
Soccer-ball fullerene
(made of 20 hexagons
and 12 pentagons)



Common Names:

[70]fullerene
Fullerene- C_{70}
(C_{70} - D_{5h})[5,6]fullerene
Rugbyballene
(made of 25 hexagons
and 12 pentagons)

Mohammad Shahid

The Chemistry Of Fullerenes Fullerenes

Andreas Hirsch, Michael Brettreich



The Chemistry Of Fullerenes Fullerenes:

The Chemistry of the Fullerenes Andreas Hirsch (Dr. rer. nat.), 1994 **The Chemistry of Fullerenes** Roger Taylor, 1995 The closed cage carbon molecules known as fullerenes provide an entirely new branch of chemistry materials science and physics Fullerene research is now engaging the frenetic attention of thousands of scientists Initially the chemistry was relatively slow to develop due to the low availability of material and the need for state of the art instrumentation for product analysis This research area is now very definitely up and running and will soon become the main focus of attention in the fullerene field The number of published papers already runs into hundreds and the main features of fullerene reactivity have been established This book describes all of the known types of reactions as well as the means of production the purification and the properties of fullerenes *Fullerenes* Andreas Hirsch, Michael Brettreich, 2006-03-06 In this handbook the leading experts in the field presents important and fundamental aspects of the organic and organometallic chemistry of fullerenes Naturally they also cover the applications in material and medicinal science for these fascinating molecules Completely self contained the book is logically arranged such that information is easy to retrieve and the style lends itself to effortless reading and to learning more about the chemical properties of this family of molecules A definitive must for everyone working in this ever expanding sphere **The Chemical Physics of Fullerenes 10 (and 5) Years Later** W. Andreoni, 1996-03-31 A decade has elapsed since the discovery of C₆₀ in molecular beams and five years since the first synthesis of solid C₆₀ At the time the opening of a new era for chemistry was foreseen and high expectations were shared by physicists and material scientists Where are we now Where are we aiming What can we expect from now on The answer will be found in this volume written by the protagonists of the fullerene adventure There is a whole new generation of materials now in the form of molecules solids nanostructures either directly derived from Bucky or inspired by it They continue to create new challenges to our fundamental understanding and seem to be ready for important long lasting applications Audience The book is mainly directed to specialized scientists physicists chemists material scientists and biochemists who will find it a source of learning and inspiration Younger researchers too will find it fascinating since it allows them to learn about and quickly acquire a critical view of an interdisciplinary frontier subject *Physics and Chemistry of the Fullerenes* K. Prassides, 2012-12-06 In September 1985 in an attempt to simulate the chemistry in a carbon star Harry Kroto Bob Curl and Richard Smalley set up a mass spectrometry experiment to study the plasma produced by focusing a pulsed laser on solid graphite Serendipitously a dominant 720 amu mass peak corresponding to a C₆₀ species was revealed in the time of flight mass spectrum of the resulting carbon clusters It was proposed that this C₆₀ cluster had the closed cage structure of a truncated icosahedron a soccerball and was named Buckminsterfullerene because geodesic dome concepts pioneered by the architect Buckminster Fuller played an important part in arriving at this solution The signal for a C₇₀ species 840 amu proposed to have the ellipsoidal shape of a rugbyball was also prominent in the early experiments Five years

later the seminal work of the Sussex Rice collaboration was triumphantly confirmed as Wolfgang Krlitschmer and Donald Huffman succeeded in producing and separating bulk crystalline samples of fullerene material from arc processed in an inert gas atmosphere carbon deposits From then onwards fullerene research continued and still proceeds at an exhilarating pace The materials excited the imagination of many diverse classes of scientists resulting in a truly interdisciplinary field Many of our old seemingly well founded preconceptions in carbon science had to be radically altered or totally abandoned as a new round world of chemistry physics and materials science began to unfold Fullerenes Karl M. Kadish, Rodney S.

Ruoff, 2000-07-06 Fullerenes a guide to the current state of knowledge in the field The last decade has seen an explosion of research into the chemical and physical properties of a promising new class of carbon based materials known as fullerenes Karl Kadish and Rodney Ruoff two highly recognized leaders in the fullerene and nanotube research community edit a comprehensive and much needed survey of this important and rapidly evolving field Contributions by experts in diverse areas of chemistry physics pharmacology materials science and chemical engineering provide an excellent introduction to fullerenes and highlight their considerable potential in such cutting edge applications as semiconductor materials new pharmaceutical compounds and polymers From the electrochemistry of fullerenes to molecular and solid C₃₆ this book offers a remarkably fresh and authoritative look at some of the hottest research topics today including Organic functionalization of fullerenes Photophysical properties of different types of fullerenes Polyfunctional polymer derivatives of fullerenes The theory and production of endohedral metallofullerenes Fullerene surface interactions Superconductivity in fullerenes Synthesis of materials incorporated within carbon nanotubes

Recent Advances in the Chemistry and Physics of Fullerenes and Related Materials Prashant V. Kamat, D. M. Guldi, Karl M. Kadish, 1999 **The Fullerenes** H. W. Kroto, D. R. M. Walton, 1993-09-09 In 1985 Buckminsterfullerene fullerene C₆₀ was discovered serendipitously during graphite laser vaporisation experiments designed to simulate the chemistry in a red giant carbon star The molecule was isolated for the first time in macroscopic amounts in 1990 a breakthrough which triggered an explosion of research into its chemical and physical properties The fullerenes hold great potential for material science applications such as semiconductors and microscopic engineering and as new compounds for pharmaceuticals polymers and the chemical industry In October 1992 a Discussion Meeting of the Royal Society entitled A Post Buckminsterfullerene View of the Chemistry Physics and Astrophysics of Carbon organised by H W Kroto A L Makay G Turner and D R M Walton was held to celebrate this exciting advance The scientists who played key roles in the discovery and who are currently uncovering fascinating problems and the implications of this elegant molecule presented the papers published in this book Physics And Chemistry Of Fullerenes Peter W Stephens, 1993-11-24 The creation of the hollow carbon buckminsterfullerene molecule as well as methods to produce and purify bulk quantities of it has triggered an explosive growth of research in the field Superconducting and magnetic fullerides atoms trapped inside the fullerene cage chemically bonded fullerene complexes and nanometer scale

helical carbon tubes are some of the leading areas that have generated much excitement This book is intended as a guide to the literature for the scientist who is just entering fullerene research and will be one more valuable volume to the collection for the established worker It contains reprints of some sixty most important research papers with focus especially on those papers that have guided further work in the field There is also a short review of the field with references to many other publications Endohedral Fullerenes: From Fundamentals To Applications Shangfeng Yang, Chun-ru Wang, 2014-04-01

Endohedral fullerenes represent a novel family of carbon nanostructures which are characterized by a robust fullerene cage with atoms ions or clusters trapped in its interior Since the first separation of the endohedral metallofullerene La C₈₂ in 1991 a large variety of endohedral structures have been isolated and their endohedral nature has been proved by experimental studies Within the past two decades the world of endohedral fullerenes was significantly enlarged by the clusterfullerenes and the new carbon cages including non IPR IPR isolated pentagon rule structures Resulting from the charge transfer from the encaged species to the fullerene cage endohedral fullerenes hold a lot of fascinating properties inaccessible by the empty fullerenes and consequently promise potential applications in biomedicine molecular electronics and photonics etc The book provides a comprehensive overview of endohedral fullerenes focused on the new advances in the past decade including its fundamentals structures synthesis isolation characterization properties functionalization as well as the applications thus representing the most updated and broad review of this exciting field *An Atlas of Fullerenes* P. W. Fowler, D. E. Manolopoulos, 2007-01-01 An introduction to the current state of theory in a new and lively field this volume offers both students and researchers a practical guide It features a comprehensive set of pictures of fullerene structures and tabulates their properties In addition it lists a computer program that will extend the tables as needed Seven chapters of descriptive material precede over 200 pages of tables with corresponding diagrams and serve as a self contained introduction Topics include fullerene cages electronic structure steric strain symmetry and spectroscopy fullerene isomerization and carbon gain and loss Each chapter concludes with references and notes Fragments of Fullerenes and Carbon Nanotubes Marina A. Petrukhina, Lawrence T. Scott, 2011-11-01 This book is the first of its kind to reflect upon the intense and rapidly growing interest in open geodesic polyaromatic molecules specifically focusing on their synthesis and reactivity in metal binding reactions The book broadly covers all aspects related to the fullerene fragment chemistry current synthetic techniques description of the available members of this new family which has grown to more than two dozens members with none being available commercially molecular geometry and trends in the solid state packing as well as extensions into physical properties and new buckybowl based molecules and materials It covers fundamental research related to a new class of hydrocarbons namely open geodesic polyarenes that map onto the surfaces of fullerenes and referred to as fullerene fragments or buckybowls **The Fullerenes** H.W. Kroto, J.E. Fischer, Deann Cox, 2012-12-02 Until recently the element carbon was believed to exhibit only two main allotropic forms diamond and graphite Research in the US

and Europe has now confirmed the existence of a third previously unknown form buckminsterfullerene C₆₀ and its relatives the fullerenes C₂₄ C₂₈ C₃₂ C₇₀ etc The story of fullerene chemistry physics and materials science began in 1985 almost twenty years after the existence of a spherical carbon cluster was first considered In September 1985 a joint Sussex Rice Universities team including Kroto Heath O'Brien Curl and Smalley used a powerful mass spectrometric technique to identify the C₆₀ species and proposed a spherical structure and the name buckminsterfullerene It was not however until Kratschmer and Huffman reported the isolation of crystals of C₆₀ in 1990 that the closed cage structure of C₆₀ could be confirmed The Fullerenes documents the work leading up to 1990 and more recent developments in the field of fullerene research and will serve as an indispensable reference tool for all workers in this area

Proceedings of the Symposium on Recent Advances in the Chemistry and Physics of Fullerenes and Related Materials Karl M. Kadish, Rodney S. Ruoff, 1996

Proceedings of the Symposium on Recent Advances in the Chemistry and Physics of Fullerenes and Related Materials Electrochemical Society. Fullerenes Group, 1998

Physics And Chemistry Of Fullerenes And Derivatives - Proceedings Of The International Winterschool On Electronic Properties Of Novel Materials Jorg Fink, Hans Kuzmany, Michael Mehring, Siegmund Roth, 1995-06-30 The year 1995 witnessed the tenth anniversary of the International Winterschools in Kirchberg Tyrol Austria These schools are devoted to the Electronic Properties of Novel Materials having started with coverage of research on conducting polymers and high temperature superconductors to presently focusing on Fullerene the newly discovered third allotrope of carbon This year's proceedings present about ten tutorial and review papers on physics chemistry and material science of Fullerene Fullerene derivatives and nanotubes as well as about a hundred research contributions on the latest development in this field including a summary on the assessment of the applications potential of the materials and phenomena which have already evolved from the activities in the past couple of years

Fullerenes and Relative Materials Natalia Kamanina, 2018-04-25 In the period of rapid and intensive development of general electronics this book entitled Fullerenes and Relative Materials Properties and Applications is quite systematic and useful It considers some aspects on synthesis structural vibrational tribology and optical properties of the fullerenes and relative materials Some parts of the book present the specific area of the applications of the studied nanostructures The book contains eight chapters The special approach and interesting results on the unique properties of the materials studied as well as the different areas of their applications in general optoelectronics solar energy and gas storage laser and display and biomedicine are shown It is important for education process and for the civil and special device operations

The Chemistry Of Fullerenes Roger Taylor, 1995-08-31 The closed cage carbon molecules known as fullerenes provide an entirely new branch of chemistry materials science and physics Fullerene research is now engaging the frenetic attention of thousands of scientists Initially the chemistry was relatively slow to develop due to the low availability of material and the need for state of the art instrumentation for product analysis This research area is now very definitely up and running and

will soon become the main focus of attention in the fullerene field. The number of published papers already runs into hundreds and the main features of fullerene reactivity have been established. This book describes all of the known types of reactions as well as the means of production, the purification and the properties of fullerenes. *Radical Reactions of Fullerenes and their Derivatives* B.L. Tumanskii, O. Kalina, 2006-04-11. The discovery of fullerene species belonging to the electron-deficient polyalkenes with weakly conjugated double bonds has opened novel opportunities for the radical chemistry. Pioneering study in this field was performed by P.J. Krusic, E. Wasserman, P.N. Keizer, J.R. Morton and K.F. Preston. Science 1991, 254, 1184. The fullereryl radical adducts formed via addition of atoms or free radicals to fullerenes have no analogs in organic chemistry. In fact, radicals in which the unpaired electrons are delocalized over the surface of a sphere or ellipsoid have never been studied before. The unusual character of the fullereryl radicals is also due to the fact that they occupy a sort of intermediate position between the planar and tetrahedral radicals. Thus, the elucidation of the characteristic features of fullereryl radicals and their reactivity by EPR spectroscopy and the comparison of the results with those of quantum chemical studies are of fundamental importance. Isolation of the products from homolytic reactions of fullerenes in bulk amounts opens the door to large-scale preparation of new organic and organoelement derivatives, including biologically active ones. Radical reactions of fullerenes find wide application in the synthesis of fullerenes containing polymers with valuable photophysical characteristics. Ferromagnetism of the complex of with tetra dimethylamino ethylene found lends impetus to a search of novel methods for preparation of biradicals: one unpaired electron of those is located on the fullerene cage while the other retained by the addend.

Fullerenes Fernando Langa De La Puente, Jean-Francois Nierengarten, 2011-10-31. The discovery of caged carbon structures in 1985 established a whole new field of carbon chemistry. Unlike graphite and diamond, these structures, known as fullerenes, are finite in structure and are relevant to a wide variety of fields, including supramolecular assemblies, nanostructures, optoelectronic devices, and a whole range of biological activities. *Fullerenes: Principles and Applications* discusses all aspects of this exciting field. Sections include the basic principles for the chemical reactivity of fullerenes, electrochemistry, light-induced processes, fullerenes for material sciences, fullerenes and solar cells, biological applications, and multifunctional carbon nanotube materials. Written by leading experts in the field, the book summarises the basic principles of fullerene chemistry but also highlights some of the most remarkable advances that have occurred in recent years. *Fullerenes: Principles and Applications* will appeal to researchers in both academia and industry.

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