

C60: Buckminsterfulleren

en litteraturliste fra Roskilde universitetsbibliotek

Møller, Søren

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Søren Møller

C₆₀: Buckminsterfulleren

-En litteraturliste fra Roskilde Universitetsbibliotek

Indholdsfortegnelse

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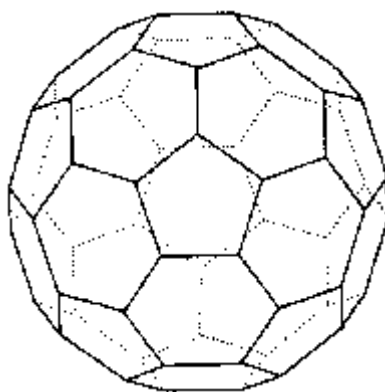
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1. Indledning

I 1985 publiceredes i det yderst ansete engelske tidsskrift *Nature* en lille to-siders artikel med titlen C₆₀:Buckminsterfullerene (Kroto, H.W.; Heath, J.R.; O'Brien, S.C.; Curl, R.F.; Smalley, R.E.: *Nature*, **318**, 162-3, 1985). Hermed var startskuddet gået for en nærmest eksplosionsagtig interesse for denne nye form for kulstof, som hverken kan beskrives som grafit eller diamant. Navnet buckminsterfulleren blev valgt til ære for en berømt amerikansk arkitekt (R. Buckminster Fuller, 1895-1983), som til verdensudstillingen i Montreal i 1967 konstruerede en stor gennemsigtig kugle bygget op af fem- og sekskanter, nøjagtig som en fodbold. Navne som ballene, sphere, soccer og carbosoccer blev da også foreslået af forfatterne. Den endelige bekræftelse af strukturen kom med publikationen af det første ¹³C-NMR spektrum af C₆₀ (Taylor, R.; Hare, J.P.; Abdul-Sada, A.K.; Kroto, H.W.: *J.Chem.Soc., Chem.Comm.*, 1423-25, No.20, 1990).

Buckminsterfulleren er blot et molekyle (omend usædvanligt stabilt) ud af en klasse af kugleformede kulstofmolekyler, C_n, hvor n=20-200 (ca.). Denne klasse kaldes med et fælles navn fullerener.



C₆₀: Buckminsterfulleren

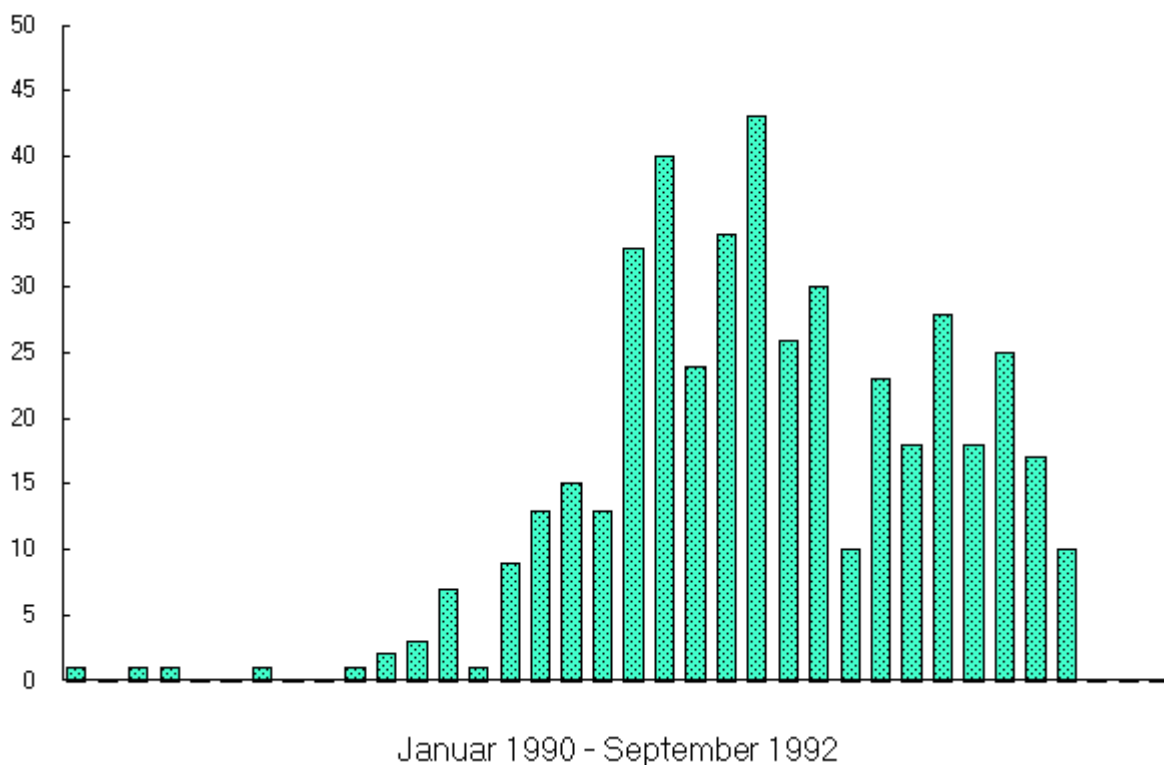
Der er til dato blevet citeret ca. 850 artikler i Chemical Abstracts hvor CAS-nummeret [99685-96-8] for C₆₀ indgår. Figur 1 viser antallet af C₆₀ artikler citeret i *Current Contents* fordelt på udgivelsesmåned i perioden fra januar 1990 til dato.

Interessen samlede sig i begyndelsen om verifikation af strukturen, men siden er der publiceret artikler om bl.a. C₆₀'s optræden i det interstellare verdensrum, kemiske reaktioner med C₆₀, C₆₀ som 'cage'-molekyle og C₆₀ som superleder. Anvendelser for C₆₀ kan man P.T. kun spekulere om, men der har været foreslået oplagte muligheder som f.eks. komponent i smøremidler, transportør af radioaktive metalatomer i organismen i

forbindelse med sygdomsbehandling og som forstadie ved fremstilling af kunstige diamanter. I Danmark foregår C₆₀ forskningen især på Forskningscenter Risø, hvor man har den (vistnok) eneste facilitet i Europa til fremstilling af stoffet i ren form.

I denne litteraturliste for C₆₀ er samlet publikationer af mere eller mindre populær karakter (kapitel 2), en komplet liste af C₆₀ artikler publiceret i *Nature* og *Science* (kapitel 3) og konferencer (kapitel 4). De to tidsskrifter *Nature* og *Science* er valgt fordi de bringer de nyeste og mest markante forskningsresultater.

Al litteratur medtaget i denne liste haves på **RUB** eller er under anskaffelse. God fornøjelse med dette spændende nye emne.



Figur 1. C₆₀ artikler citeret i *Current Contents* i perioden januar 1990 til september 1992.

2. Publikationer af populær karakter

Larsen, E.; Egsgaard, H.; Skytte Jensen, B.; Bohr, J.
C₆₀/C₇₀, Fysik og Kemi.
Dansk Kemi **6/7**, 10-13, 1992.

Sveinsdottir, S.
Spillet om fodboldkulstof er igang.
Ingeniøren nr. **7**, 12-13, 1992

Schmidt, O.H.; Strand, J.; Rasmussen, J.
Dannelse af Fullerener.
Projektrapport, Den naturvidenskabelige basisuddannelse,
Roskilde Universitetscenter (dupl.), 1992.

Enkel syntes av nytt kol sätter fart på forskarna
Kemisk Tidskrift nr. **1**, 7, 1991

Kroto, H.W.
C₆₀: Buckminsterfulleren, die Himmelssphäre, die zur Erde fiel.

Angewandte Chemie, **104**, 113-133, 1992

Smalley, R.E.

Great Balls of Carbon: The Story of Buckminsterfullerene.
The Sciences, **31**, 22-28, 1991

Baggott, J.

Great Balls of Carbon.
New Scientist, **131**, 34-38, 1991

Curl, R.F.; Smalley, R.E.

Fullerenes.
Scientific American 32-41, October 1991

3. Artikler i Nature og Science

Artikler i Nature i kronologisk orden

Wang, Y.

Photoconductivity of fullerene-doped polymers
Nature, **356**, 585-7, 1992

Tanigaki, K.; Hirose, I.; Ebbesen, T. W.; Mizuki, J.; Shimakawa, Y.; Kubo, Y.; Tsai, J. S.; Kuroshima, S.

Superconductivity in sodium- and lithium-containing alkali-metal fullerenes
Nature, **356**, 419-21, 1992

Rosseinsky, M. J.; Murphy, D. W.; Fleming, R. M.; Tycko, R.; Ramirez, A. P.; Siegrist, T.; Dabbagh, G.; Barrett, S. E.

Structural and electronic properties of sodium-intercalated fullerene C₆₀
Nature, **356**, 416-18, 1992

Tutt, Lee W.; Kost, Alan

Optical limiting performance of C₆₀ and C₇₀ solutions
Nature, **356**, 225-6, 1992

Zhu, Qing; Cox, David E.; Fischer, John E.; Kniaz, Krzysztof; McGhie, Andrew R.; Zhou, Otto

Intercalation of solid C₆₀ with iodine
Nature, **355**, 712-14, 1992

Nunez Regueiro, Manuel; Monceau, Pierre; Hodeau, Jean Louis

Crushing C₆₀ to diamond at room temperature
Nature, **355**, 237-9, 1992

Nunez Regueiro, M.; Monceau, P.; Rassat, A.; Bernier, P.; Zahab, A.

Absence of the metallic phase at high pressures in fullerene (C₆₀)
Nature, **354**, 289-91, 1991

David, William I. F.; Ibberson, Richard M.; Matthewman, Judy C.; Prassides, Kosmas; Dennis, T. John S.; Hare, Jonathan P.; Kroto, Harold W.; Taylor, Roger; Walton, David R. M.

Crystal structure and bonding of ordered carbon cluster C₆₀
Nature, **353**, 147-9, 1991

Ansaldo, E. J.; Niedermayer, C.; Stronach, C. E.

Muonium in fullerite
Nature, **353**, 121, 1991

Fleming, R. M.; Ramirez, A. P.; Rosseinsky, M. J.; Murphy, D. W.; Haddon, R. C.; Zahurak, S. M.; Makhija, A. V.

Relation of structure and superconducting transition temperatures in A_3C_{60} (alkali-metal-doped fullerenes)
Nature, **352**, 787-8, 1991

Rosseinsky, M. J.; Ramirez, A. P.; Murphy, D. W.; Tully, J. C.; Haddon, R. C.; Siegrist, T.; Tycko, R.; Glarum, S. H.; et al.

Preparation and structure of the alkali-metal fulleride A_4C_{60} Fleming, R. M.;
Nature, **352**, 701-3, 1991

Uemura, Y. J.; Keren, A.; Le, L. P.; Luke, G. M.; Sternlieb, B. J.; Wu, W. D.; Brewer, J. H.; Whetten, R. L.; Huang, S. M.; et al.

Magnetic-field penetration depth in potassium doped fullerene (K_3C_{60}) measured by muon spin relaxation
Nature, **352**, 605-7, 1991

Chen, C. T.; Tjeng, L. H.; Rudolf, P.; Meigs, G.; Rowe, J. E.; Chen, J.; McCauley, J. P., Jr.; Smith, A. B., III; McGhie, A. R.; et al.

Electronic states and phases of K_xC_{60} from photoemission and x-ray absorption spectroscopy
Nature, **352**, 603-5, 1991

Kelty, Stephen P.; Chen, Chia Chun; Lieber, Charles M.

Superconductivity at 30 K in cesium-doped fullerene
Nature, **352**, 223-5, 1991

Howard, Jack B.; McKinnon, J. Thomas; Makarovskiy, Yakov; Lafleur, Arthur L.; Johnson, M. Elaine

Fullerenes C_{60} and C_{70} in flames
Nature, **352**, 139-41, 1991

Guo, Yuejin; Karasawa, Naoki; Goddard, William A., III

Prediction of fullerene packing in C_{60} and C_{70} crystals
Nature, **351**, 464-7, 1991

Hebard, A. F.; Rosseinsky, M. J.; Haddon, R. C.; Murphy, D. W.; Glarum, S. H.; Palstra, T. T. M.; Ramirez, A. P.; Kortan, A. R.

Superconductivity at 18 K in potassium-doped fullerene (C_{60})
Nature, **350**, 600-1, 1991

Haddon, R. C.; Hebard, A. F.; Rosseinsky, M. J.; Murphy, D. W.; Duclos, S. J.; Lyons, K. B.; Miller, B.; Rosamilia, J. M.; Fleming, R. M.; et al.

Conducting films of C_{60} and C_{70} by alkali-metal doping
Nature, **350**, 320-2, 1991

Haddon, R. C.; Schneemeyer, L. F.; Waszczak, J. V.; Glarum, S. H.; Tycko, R.; Dabbagh, G.; Kortan, A. R.; Muller, A. J.; Muijsce, A. M.; et al.

Experimental and theoretical determination of the magnetic susceptibility of C_{60} and C_{70}
Nature, **350**, 46-7, 1991

Wragg, J. L.; Chamberlain, J. E.; White, H. W.; Kraetschmer, W.; Huffman, Donald R.

Scanning tunnelling microscopy of solid C_{60}/C_{70}
Nature, **348**, 623-4, 1990

Wilson, R. J.; Meijer, G.; Bethune, D. S.; Johnson, R. D.; Chambliss, D. D.; De Vries, M. S.; Hunziker, H. E.; Wendt, H. R.

Imaging C_{60} clusters on a surface using a scanning tunnelling microscope
Nature, **348**, 621-2, 1990

Kraetschmer, W.; Lamb, Lowell D.; Fostiropoulos, K.; Huffman, Donald R.

Solid C_{60} : a new form of carbon
Nature, **347**, 354-8, 1990

Kroto, H. W.

The stability of the fullerenes C_n , with $n = 24, 28, 32, 36, 50, 60$ and 70
 Nature, **329**, 529-31, 1987

Elser, V.; Haddon, R. C.

Icosahedral C_{60} : an aromatic molecule with a vanishingly small ring current magnetic susceptibility
 Nature, **325**, 792-4, 1987

Klein, D. J.; Seitz, W. A.; Schmalz, T. G.

Icosahedral symmetry carbon cage molecules
 Nature, **323**, 703-6, 1986

Kroto, H. W.; Heath, J. R.; O'Brien, S. C.; Curl, R. F.; Smalley, R. E.

C_{60} : buckminsterfullerene
 Nature, **318**, 162-3, 1985

Artikler i Science i kronologisk orden**Alers, G. B.; Golding, Brage; Kortan, A. R.; Haddon, R. C.; Theil, F.A.**

Existence of an orientational electric dipolar response in fullerene (C_{60}) single crystals
 Science, **257**, 511-14, 1992

Buseck, Peter R.; Tsipursky, Semeon J.; Hettich, Robert

Fullerenes from the geological environment
 Science, **257**, 215-17, 1992

Tebbe, Fred N.; Harlow, Richard L.; Chase, D. Bruce; Thorn, David, L.; Campbell, G. Creston, Jr.; Calabrese, Joseph C.; Herron, Norman; Young, Robert J., Jr.; Wasserman, E.

Synthesis and single-crystal x-ray structure of a highly symmetrical fullerene (C_{60}) derivative, brominated fullerene ($C_{60}Br_{24}$)
 Science, **256**, 822-5, 1992

Johnson, Robert D.; Yannoni, Costantino S.; Dorn, Harry C.; Salem, Jesse R.; Bethune, Donald S.

Buckminsterfullerene (C_{60}) rotation in the solid state: dynamics of a faceted spherical top
 Science, **255**, 1235-8, 1992

Kochanski, G. P.; Hebard, A. F.; Haddon, R. C.; Fiory, A. T.

Electrical resistivity and stoichiometry of K_xC_{60} films
 Science, **255**, 184-6, 1992

Duclos, S. J.; Haddon, R. C.; Glarum, S.; Hebard, A. F.; Lyons, K.B.

Raman studies of alkali-metal doped A_xC_{60} films ($A = Na, K, Rb$, and Cs ; $x = 0, 3$, and 6)
 Science, **254**, 1625-7, 1992

Zhang, Zhe; Chen, Chia Chun; Lieber, Charles M.

Tunneling spectroscopy of M_3C_{60} superconductors: the energy gap, strong coupling, and superconductivity
 Science, **254**, 1619-21, 1991

Yoo, C. S.; Nellis, W. J.

Phase transformations in carbon fullerenes at high shock pressures
 Science, **254**, 1489-91, 1991

Suzuki, T.; Li, Q.; Khemani, K. C.; Wudl, F.; Almarsson, O.

Systematic inflation of buckminsterfullerene C_{60} : synthesis of diphenylfulleroids C_{61} to C_{66}
 Science, **254**, 1186-8, 1991

Krusic, P. J.; Wasserman, E.; Keizer, P. N.; Morton, J. R.; Preston, K. F.

Radical reactions of C_{60}

Science, **254**, 1183-5, 1991

Varma, C. M.; Zaanen, J.; Raghavachari, K.

Superconductivity in the fullerenes

Science, **254**, 989-92, 1991

Chakravarty, Sudip; Gelfand, Martin P.; Kivelson, Steven

Electronic correlation effects and superconductivity in doped fullerenes

Science, **254**, 970-4, 1991

**Iqbal, Zafar; Baughman, Ray H.; Ramakrishna, B. L.; Khare, Sandeep; Murthy, N. Sanjeeva;
Bornemann, Hans J.; Morris, Donald E.**

Superconductivity at 45 K in rubidium/thallium codoped fullerene C₆₀ and C₆₀/C₇₀ mixtures

Science, **254**, 826-9, 1991

**Hedberg, Kenneth; Hedberg, Lise; Bethune, Donald S.; Brown, C. A.; Dorn, H. C.; Johnson, Robert D.;
De Vries, M.**

Bond lengths in free molecules of buckminsterfullerene, C₆₀, from gas-phase electron diffraction

Science, **254**, 410-12, 1991

Liu, Shengzhong; Lu, Ying Jie; Kappes, Manfred M.; Ibers, James A.

The structure of the C₆₀ molecule: x-ray crystal structure determination of a twin at 110 K

Science, **254**, 408-10, 1991

Chen, Chia Chun; Kelty, Stephen P.; Lieber, Charles M.

(Rb_xK_{1-x})₃ C₆₀ superconductors: formation of a continuous series of solid solutions

Science, **253**, 886-8, 1991

**Poirier, D. M.; Ohno, T. R.; Kroll, G. H.; Chen, Y.; Benning, P. J.; Weaver, J. H.; Chibante, L. P. F.;
Smalley, R. E.**

Formation of fullerides and fullerene-based heterostructures

Science, **253**, 646-8, 1991

Li, Y. Z.; Chander, M.; Patrin, J. C.; Weaver, J. H.; Chibante, L. P. F.; Smalley, R. E.

Order and disorder in C₆₀ and K_xC₆₀ multilayers: direct imaging with scanning tunneling microscopy

Science, **253**, 429-33, 1991

**Allemand, Pierre Marc; Khemani, Kishan C.; Koch, Andrew; Wudl, Fred; Holczer, Karoly; Donovan,
Steven; Gruner, George; Thompson, Joe D.**

Organic molecular soft ferromagnetism in a fullerene C₆₀

Science, **253**, 301-3, 1991

**Snyder, Eric J.; Anderson, Mark S.; Tong, William M.; Williams, R. Stanley; Anz, Samir J.; Alvarez,
Marcos M.; Rubin, Yves; Diederich, Francois N.; Whetten, Robert L.**

Atomic force microscope studies of fullerene films: highly stable C₆₀ fcc (311) free surfaces

Science, **253**, 171-3, 1991

**Wertheim, G. K.; Rowe, J. E.; Buchanan, D. N. E.; Chaban, E. E.; Hebard, A. F.; Kortan, A. R.;
Makhija, A. V.; Haddon, R. C.**

Photoemission spectra and electronic properties of K_xC₆₀

Science, **252**, 1419-21, 1991

**Fischer, John E.; Heiney, Paul A.; McGhie, Andrew R.; Romanow, William J.; Denenstein, Arnold M.;
McCauley, John P., Jr.; Smith, Amos B., III**

Compressibility of solid C₆₀

Science, **252**, 1288-90, 1991

Fagan, Paul J.; Calabrese, Joseph C.; Malone, Brian

The chemical nature of buckminsterfullerene (C₆₀) and the characterization of a platinum derivative

Science, **252**, 1160-1, 1991

Diederich, Francois; Ettl, Roland; Rubin, Yves; Whetten, Robert L.; Beck, Rainer; Alvarez, Marcos; Anz, Samir; Sensharma, Dilip; Wudl, Fred; et al.

The higher fullerenes: isolation and characterization of C₇₆, C₈₄, C₉₀, C₉₄, and C₇₀O, an oxide of D_{5h}-C₇₀
Science, **252**, 548-51, 1991

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Crystal structure of osmylated C₆₀: confirmation of the soccer ball framework
Science, **252**, 312-13, 1991

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Space, stars, C₆₀, and soot
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Washington, DC: American Chemical Society, 1992. ACS symposium series 481.

Jack M. Williams et al. (eds.)

Organic superconductors (including fullerenes) : synthesis, structure, properties, and theory
Englewood Cliffs, N.J.: Prentice Hall, 1992.
Prentice Hall inorganic and organometallic chemistry series.

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