

## The *JPC* Periodic Table

In this *Virtual Issue*, we celebrate the International Year of the Periodic Table by presenting one paper in *JPC* that is concerned with each of the 118 elements. Actually only 116 elements have appeared in *JPC* papers, with elements 109 and 110, meitnerium and darmstadtium, somehow missing as far as we can tell. However, all the rest are there, and the *JPC* editors, including editors of *JPC A, B, C*, and *Letters*, have all contributed to the list given below, with links to the original articles provided. In choosing these papers, we tried to focus mostly on papers that are well cited and that refer to the element of interest rather than to complex chemistry where the element is one of many involved. However, in many cases the importance of an element is defined by its role in important molecules or materials, so some of the papers are concerned with the physical chemistry of the molecules or materials. Of course, many of the chemical elements have multifaceted personalities when it comes to their physical chemistry, so we apologize that we could only list one paper for each element when, in fact, there were many excellent choices. Near the bottom of the periodic table ( $Z > 100$ ), the number of papers concerned with some elements is quite limited, so the few people brave enough to study these elements receive a lot of publicity in this document.

There are numerous interesting stories that are woven through these papers. We could easily write a story about each element, but to keep this discussion focused, let us only mention a few general issues. It is notable to think about the dates on these papers and when the elements were discovered. The elements with  $Z > 92$  were all discovered since 1940, so many of the papers on our list refer to physical property measurements that were done shortly after their discovery. And elements with  $Z > 99$  are sufficiently unstable that most of the papers refer to computational studies or empirical models, sometimes done in advance of the discovery of the element (and often before the element had a name, so only the atomic number appears in the paper, or perhaps the name “Eka- $X$ ” where  $X$  is the corresponding element from the row above on the periodic table). Theory plays an important role with many of the lighter (but still heavy) elements, particularly those that are radioactive ( $Z > 83$ ) and are in low abundance. There have also been several experimental papers concerned with the radioactive properties of these elements. We were not able to include papers going back to the beginning of *JPC* in 1896, but one can find papers by Marie and Pierre Curie and Henri Becquerel that refer to some of the very first measurements on Po, Ra, and other radioactive elements.

Among the elements with  $Z < 100$ , one theme refers to elements that are gases, including the rare gases (but some of our papers for those refer to liquid or solid forms) and non rare gas molecules that form gaseous diatomics ( $N_2, O_2, Cl_2, Br_2, I_2$ ). The papers in this case refer to spectroscopic measurements or, in some cases, gas-phase chemical reactions of either neutrals or ions. There are many elements where ions in solution are extremely important (our papers include  $K^+, Rb^+, Cs^+, Mg^{2+}, Pr^{3+}, Np^{3+}, Cm^{3+}, Bk^{3+}, Cf^{3+}, Es^{3+}$ , and  $Fm^{3+}$ ). Many of these

ions are important in biophysics, and we also note that our papers on O and S are concerned with biophysics.

Several of the papers are concerned with elemental liquids or solids either as covalent materials (C, Si, Ge, S, Sb, Ti) or as metals (alkalis, noble metals, Fe, Ni, Nb, Pd). Of course, water and solvation are prominently featured (H) and occasionally elements that form molecular liquids (Be). Many of the metals in the table form colloids (noble metals), and then there are the important oxides, sulfides, nitrides, arsenides, etc. that form nanostructures of various types (Ti, Sc, Zr, Cd, Sn, La, Ce, Ir, Pb, Bi, Th, Pa, U, Am), including 2D nanomaterials (F, B, P, As). Battery materials show up in many places (Li, P, Se), and we also find examples of elements that play a crucial role in coordination chemistry (Ru, Rh), catalysis (N, Fe, Sr, Mo, Re, Pt), electronic materials (In, Te, Hf, Ta, W), and intermetallics (Sb, Po). Thermodynamic properties and earth abundance are important in some of papers we cite. Ca, Ba, Tc, At, Fr, Pu, and the lanthanides have their expected roles as emitters, contrast agents, and electronic materials. Finally, we note that the paper we list for Hg involves the use of mercury drop to describe autonomous motion in the presence of a  $K_2Cr_2O_7$  crystal.

This discussion amply notes the incredible richness associated with the periodic table that one sees in a list of 116 papers. We are delighted that *JPC* has been able to play (thanks for Cathy Murphy’s suggestion) an important role in the dissemination of these scientific discoveries.

### (AN#1) - H - Hydrogen

Polarizable Atomic Multipole Water Model for Molecular Mechanics Simulation, Pengyu Ren and Jay W. Ponder  
*J. Phys. Chem. B* **2003**, 107 (24), pp 5933–5947  
DOI: [10.1021/jp027815+](https://doi.org/10.1021/jp027815+)  
Publication Date (Web): May 24, 2003  
*Introduction of the AMOEBA polarizable force field for water* –ABM

### (AN#2) - He - Helium

Helium Separation Using Porous Graphene Membranes, Joshua Schrier  
*J. Phys. Chem. Lett.* **2010**, 1 (15), pp 2284–2287  
DOI: [10.1021/jz100748x](https://doi.org/10.1021/jz100748x)  
Publication Date (Web): July 8, 2010  
*Computational study of He transmission through graphene, exploring the role of quantum tunneling* –ABM

### (AN#3) - Li - Lithium

Lithium–Air Battery: Promise and Challenges, G. Girishkumar, B. McCloskey, A. C. Luntz, S. Swanson, and W. Wilcke  
*J. Phys. Chem. Lett.* **2010**, 1 (14), pp 2193–2203  
DOI: [10.1021/jz1005384](https://doi.org/10.1021/jz1005384)  
Publication Date (Web): July 2, 2010  
*Perspective on Li–air batteries that highlights challenges associated with achieving high throughput air-breathing systems*

Published: July 18, 2019



that pass  $O_2$  and keep out environmental contaminants while assuring electrochemical stability of both the electrolyte and the cathode itself –FZ

(AN#4) - Be - Beryllium

A First-Principles Description of Liquid  $BeF_2$  and Its Mixtures with  $LiF$ : 1. Potential Development and Pure  $BeF_2$ , Robert J. Heaton, Richard Brookes, Paul A. Madden, Mathieu Salanne, Christian Simon, and Pierre Turq

*J. Phys. Chem. B* **2006**, *110* (23), pp 11454–11460

DOI: [Publication Date \(Web\): May 24, 2006](https://doi.org/10.1021/jp061000+</a></p></div><div data-bbox=)

*A computational study of  $BeF_2$  with comparisons to experiment* –ABM

(AN#5) - B - Boron

Soluble, Exfoliated Hexagonal Boron Nitride Nanosheets, Yi Lin, Tiffany V. Williams and John W. Connell

*J. Phys. Chem. Lett.* **2010**, *1* (1), pp 277–283

DOI: [10.1021/jz9002108](https://doi.org/10.1021/jz9002108)

Publication Date (Web): November 30, 2009

*Hexagonal boron nitride (h-BN) was functionalized using lipophilic and hydrophilic amine molecules. The functionalization induced the exfoliation of the layered structure of h-BN, resulting in few-layered and monolayered nanosheets.* –JB

(AN#6) - C - Carbon

Spectroscopic Insights into Carbon Dot Systems, Marcello Righetto, Alberto Privitera, Ilaria Fortunati, Dario Mosconi, Mirco Zerbetto, M. Lucia Curri, Michela Corricelli, Alessandro Moretto, Stefano Agnoli, Lorenzo Franco, Renato Bozio, and Camilla Ferrante

*J. Phys. Chem. Lett.* **2017**, *8* (10), pp 2236–2242

DOI: [10.1021/acs.jpcclett.7b00794](https://doi.org/10.1021/acs.jpcclett.7b00794)

Publication Date (Web): May 4, 2017

*Spectroscopic insights into carbon dot systems* –GS

(AN#7) N - Nitrogen

The Influence of Nitrogen Gas upon the Organic Catalysis of Nitrogen Fixation by Azotobacter, Dean Burk

*J. Phys. Chem.* **1930**, *34* (6), pp 1174–1194

DOI: [10.1021/j150312a005](https://doi.org/10.1021/j150312a005)

Publication Date: January 1929

*The influence of nitrogen gas upon the organic catalysis of nitrogen fixation by azotobacter* –JZ

(AN#8) - O - Oxygen

Lifetime and Diffusion of Singlet Oxygen in a Cell, Esben Skovsen, John W. Snyder, John D. C. Lambert, and Peter R. Ogilby

*J. Phys. Chem. B* **2005**, *109* (18), pp 8570–8573

DOI: [10.1021/jp051163i](https://doi.org/10.1021/jp051163i)

Publication Date (Web): April 8, 2005

*Singlet molecular oxygen, created in a single nerve cell upon irradiation of a sensitizer incorporated in the cell nucleus using a focused laser beam, was found to be long-lived and diffuse over appreciable distances including across the cell membrane into the extra-cellular environment.* –JZ

(AN#9) - F - Fluorine

Difluorophosphorane-Flattened Phosphorene through Difluorination, Dmitriy Steglenko, Ruslan M. Minyaev, Vladimir I. Minkin, and Alexander I. Boldyrev

*J. Phys. Chem. Lett.* **2018**, *9* (24), pp 6963–6966

DOI: [10.1021/acs.jpcclett.8b02918](https://doi.org/10.1021/acs.jpcclett.8b02918)

Publication Date (Web): November 27, 2018

*Fluorine - a chemical modification of phosphorene by fluorination is proposed for electronics applications* –OP

(AN#10) - Ne - Neon

Infrared Spectra of  $UO_2$ ,  $UO_2^+$ , and  $UO_2^-$  in Solid Neon, Mingfei Zhou, Lester Andrews, Nina Ismail, and Colin Marsden

*J. Phys. Chem. A* **2000**, *104* (23), pp 5495–5502

DOI: [10.1021/jp000292q](https://doi.org/10.1021/jp000292q)

Publication Date (Web): May 23, 2000

*Highly cited paper focusing on the spectroscopy of  $UO_x$  compounds in combination with calculation* –ABM

(AN#11) - Na - Sodium

An Accurate Electromagnetic Theory Study of Surface Enhancement Factors for Silver, Gold, Copper, Lithium, Sodium, Aluminum, Gallium, Indium, Zinc, and Cadmium, Ellen J. Zeman and George C. Schatz

*J. Phys. Chem.*, **1987**, *91* (3), pp 634–643

DOI: [10.1021/j100287a028](https://doi.org/10.1021/j100287a028)

Publication Date: January 1987

*Electromagnetic theory study of surface enhancement factors for plasmonic metals* –TZ

(AN#12) - Mg - Magnesium

Hydration of Beryllium, Magnesium, Calcium, and Zinc Ions Using Density Functional Theory, Maria Pavlov, Per E. M. Siegbahn, and Magnus Sandström

*J. Phys. Chem. A* **1998**, *102* (1), pp 219–228

DOI: [10.1021/jp972072r](https://doi.org/10.1021/jp972072r)

Publication Date (Web): January 1, 1998

*Well cited paper that determined  $Mg^{+2}$  hydration energy using DFT* –GCS

(AN#13) - Al - Aluminum

Reactions of Laser-Ablated Aluminum Atoms with Cyanogen: Matrix Infrared Spectra and Electronic Structure Calculations for Aluminum Isocyanides  $Al(NC)_{1,2,3}$  and Their Novel Dimers, Lester Andrews, Han-Gook Cho, and Yu Gong

*J. Phys. Chem. A* **2018**, *122* (24), pp 5342–5353

DOI: [10.1021/acs.jpca.8b02036](https://doi.org/10.1021/acs.jpca.8b02036)

Publication Date (Web): May 15, 2018

*Matrix infrared spectra and electronic calculations discover novel  $Al(NC)_{1,2,3}$  dimers and a stable anion  $Al(NC)_4^-$  from laser-ablated aluminum reacting with cyanogen.* –TC

(AN#14) - Si - Silicon

Doping and Electrical Transport in Silicon Nanowires, Yi Cui, Xiangfeng Duan, Jiangtao Hu, and Charles M. Lieber

*J. Phys. Chem. B* **2000**, *104* (22), pp 5213–5216

DOI: [10.1021/jp0009305](https://doi.org/10.1021/jp0009305)

Publication Date (Web): May 11, 2000

*Doping Si nanowires: tuning semiconductor at nanoscale. Nice demonstration!* –HZ

(AN#15) - P - Phosphorus

Electrochemical Activity of Black Phosphorus as an Anode Material for Lithium-Ion Batteries, Li-Qun Sun, Ming-Juan Li, Kai Sun, Shi-Hua Yu, Rong-Shun Wang, and Hai-Ming Xie

*J. Phys. Chem. C* **2012**, *116* (28), pp 14772–14779

DOI: [10.1021/jp302265n](https://doi.org/10.1021/jp302265n)

Publication Date (Web): June 18, 2012  
*Use of black phosphorus as an anode material for lithium ion batteries* –AG

(AN#16) - S - Sulfur  
Intermolecular Potential Functions and Monte Carlo Simulations for Liquid Sulfur Compounds, William L. Jorgensen  
*J. Phys. Chem.* **1986**, 90 (23), pp 6379–6388  
DOI: [10.1021/j100281a063](https://doi.org/10.1021/j100281a063)  
Publication Date: November 1986  
*Intermolecular potentials and Monte Carlo simulations for sulfur containing compounds, including sulfur-containing side chains of proteins* –ASM

(AN#17) - Cl - Chlorine  
The Continuous Absorption Spectra of Chlorine, Bromine, Bromine Chloride, Iodine Chloride, and Iodine Bromide, Daniel J. Seery and Doyle Britton  
*J. Phys. Chem.* **1964**, 68 (8), pp 2263–2266  
DOI: [10.1021/j100790a039](https://doi.org/10.1021/j100790a039)  
Publication Date: August 1964  
*Absorption spectra of halides* –AY

(AN#18) - Ar - Argon  
Thermal Energy Charge-Transfer Reactions of Argon Ions ( $\text{Ar}^+$  And  $\text{Ar}^{2+}$ ), R. J. Shul, B. L. Upschulte, R. Passarella, R. G. Keesee, and A. W. Castleman  
*J. Phys. Chem.* **1987**, 91 (10), pp 2556–2562  
DOI: [10.1021/j100294a022](https://doi.org/10.1021/j100294a022)  
Publication Date: May 1987  
*Castleman paper on ion–molecule reactions involving Ar.* –BS

(AN#19) - K - Potassium  
Hydration of Sodium, Potassium, and Chloride Ions in Solution and the Concept of Structure Maker/Breaker, R. Mancinelli, A. Botti, F. Bruni, M. A. Ricci, and A. K. Soper  
*J. Phys. Chem. B* **2007**, 111 (48), pp 13570–13577  
DOI: [10.1021/jp075913v](https://doi.org/10.1021/jp075913v)  
Publication Date (Web): November 8, 2007  
*Neutron diffraction experiments challenge the model of ions in aqueous solution as simply either structure makers or breakers.* –JS

(AN#20) - Ca - Calcium  
The Application of Thermoanalytical Techniques to Reaction Kinetics: The Thermogravimetric Evaluation of the Kinetics of the Decomposition of Calcium Oxalate Monohydrate, Eli S. Freeman and Benjamin Carroll  
*J. Phys. Chem.* **1958**, 62 (4), pp 394–397  
DOI: [10.1021/j150562a003](https://doi.org/10.1021/j150562a003)  
Publication Date: April 1958  
*A highly cited classic paper on the use of thermoanalytical techniques to study reaction kinetics, with applications here to the decomposition of  $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$*  –JS

(AN#21) - SC - Scandium  
Bonding within the Endohedral Fullerenes  $\text{Sc}_3\text{N}@C_{78}$  and  $\text{Sc}_3\text{N}@C_{80}$  as Determined by Density Functional Calculations and Reexamination of the Crystal Structure of  $\{\text{Sc}_3\text{N}@C_{78}\} \cdot \text{Co}(\text{OEP}) \cdot 1.5(\text{C}_6\text{H}_6) \cdot 0.3(\text{CHCl}_3)$ , Josep M. Campanera, Carles Bo, Marilyn M. Olmstead, Alan L. Balch, and Josep M. Poblet  
*J. Phys. Chem. A* **2002**, 106 (51), pp 12356–12364  
DOI: [10.1021/jp021882m](https://doi.org/10.1021/jp021882m)

Publication Date (Web): November 27, 2002  
*Details of the structure and stability of  $\text{Sc}_3\text{N}$  in two types of fullerenes* –DC

(AN#22) - Ti - Titanium  
The Role of Metal Ion Dopants in Quantum-Sized  $\text{TiO}_2$ : Correlation between Photoreactivity and Charge Carrier Recombination Dynamics, Wonyong Choi, Andreas Termin, and Michael R. Hoffmann  
*J. Phys. Chem.* **1994**, 98 (51), pp 13669–13679  
DOI: [10.1021/j100102a038](https://doi.org/10.1021/j100102a038)  
Publication Date: December 1994  
*An impactful paper on  $\text{TiO}_2$  photocatalysis* –JS

(AN#23) - V - Vanadium  
Determination of Vanadium–Oxygen Bond Distances and Bond Orders by Raman Spectroscopy, Franklin D. Hardcastle and Israel E. Wachs  
*J. Phys. Chem.* **1991**, 95 (13), pp 5031–5041  
DOI: [10.1021/j100166a025](https://doi.org/10.1021/j100166a025)  
Publication Date: June 1991  
*A well cited study that uses Raman to determine vanadium–oxygen bond distances and bond orders* –EW

(AN#24) - Cr - Chromium  
Effects of Single Metal-Ion Doping on the Visible-Light Photoreactivity of  $\text{TiO}_2$ , Jina Choi, Hyunwoong Park, and Michael R. Hoffmann  
*J. Phys. Chem. C* **2010**, 114 (2), pp 783–792  
DOI: [10.1021/jp908088x](https://doi.org/10.1021/jp908088x)  
Publication Date (Web): December 22, 2009  
*Highly cited paper on how single metal ion doping, including Cr, regulates the visible-light photoactivity of  $\text{TiO}_2$*  –FG

(AN#25) - Mn - Manganese  
Photophysical Properties of ZnS Nanoclusters with Spatially Localized  $\text{Mn}^{2+}$ , Kelly Sooklal, Brian S. Cullum, S. Michael Angel, and Catherine J. Murphy  
*J. Phys. Chem.* **1996**, 100 (11), pp 4551–4555  
DOI: [10.1021/jp952377a](https://doi.org/10.1021/jp952377a)  
Publication Date (Web): March 14, 1996  
*A highly cited paper showing that doping ZnS nanoclusters with Mn changes the photophysical properties, and even more specifically that the location of the Mn is responsible for the resulting optical properties* –GEMS

(AN#26) - Fe - Iron  
Behavior of Metallic Iron Catalysts During Fischer–Tropsch Synthesis Studied with Moessbauer Spectroscopy, X-ray Diffraction, Carbon Content Determination, and Reaction Kinetic Measurements, J. W. Niemantsverdriet, A. M. van der Kraan, W. L. van Dijk, and H. S. van der Baan  
*J. Phys. Chem.* **1980**, 84 (25), pp 3363–3370  
DOI: [10.1021/j100462a011](https://doi.org/10.1021/j100462a011)  
Publication Date: December 1980  
*Behavior of metallic iron catalysts during Fischer–Tropsch synthesis* –GL

(AN#27) - Co - Cobalt  
X-ray Absorption Spectroscopic Study of Brønsted, Lewis, and Redox Centers in Cobalt-Substituted Aluminum Phosphate Catalysts, Philip A. Barrett, Gopinathan Sankar, C. Richard A. Catlow, and John Meurig Thomas

- J. Phys. Chem.* **1996**, *100* (21), pp 8977–8985  
DOI: [10.1021/jp953034f](https://doi.org/10.1021/jp953034f)  
Publication Date (Web): May 23, 1996  
*The catalytic reactivity of Co centers on the ALPO substrates is characterized using EXAFS spectroscopy. Data acquired as a function of treatment of the porous phases are compared, revealing the local environment of the Co centers, including their oxidation state, coordination environment, and Lewis and Bronsted acid behavior.* –GRG
- (AN#28) - Ni - Nickel  
The Electrolytic Precipitation of Nickel on Nickel, Ralph C. Snowdon  
*J. Phys. Chem.* **1905**, *9* (5), pp 399–401  
DOI: [10.1021/j150068a004](https://doi.org/10.1021/j150068a004)  
Publication Date: January 1904  
*Study of the electrolytic deposition of Ni on Ni that shows the importance of removing the oxide layer Ni surface* –GVH
- (AN#29) - Cu - Copper  
Removal of Nitrogen Monoxide through a Novel Catalytic Process. 1. Decomposition on Excessively Copper-Ion-Exchanged ZSM-5 Zeolites, Masakazu Iwamoto, Hidenori Yahiro, Kenji Tanda, Noritaka Mizuno, Yoshihiro Mine, and Shuichi Kagawa  
*J. Phys. Chem.* **1991**, *95* (9), pp 3727–3730  
DOI: [10.1021/j100162a053](https://doi.org/10.1021/j100162a053)  
Publication Date: May 1991  
*A highly cited paper on copper zeolites and its role in NO removal* –JS
- (AN#30) - Zn - Zinc  
Preparation and Characterization of Quantum Size Zinc Oxide: A Detailed Spectroscopic Study, Detlef W. Bahnemann, Claudius Kormann, and Michael R. Hoffmann  
*J. Phys. Chem.* **1987**, *91* (14), pp 3789–3798  
DOI: [10.1021/j100298a015](https://doi.org/10.1021/j100298a015)  
Publication Date: July 1987  
*Synthesis and spectroscopic characterization of zinc oxide nanoparticles* –HF
- (AN#31) - Ga - Gallium  
Gallium Oxide Nanoribbons and Nanosheets, Z. R. Dai, Z. W. Pan, and Z. L. Wang  
*J. Phys. Chem. B* **2002**, *106* (5), pp 902–904  
DOI: [10.1021/jp013228x](https://doi.org/10.1021/jp013228x)  
Publication Date (Web): January 15, 2002  
*Highly cited paper on gallium oxide nanoribbons and nanosheets* –HG
- (AN#32) - Ge - Germanium  
Segregation of Impurities during the Growth of Germanium and Silicon, R. N. Hall  
*J. Phys. Chem.* **1953**, *57* (8), pp 836–839  
DOI: [10.1021/j150509a021](https://doi.org/10.1021/j150509a021)  
Publication Date: August 1953  
*Classic work on determining how to achieve desired doping levels in crystalline semiconductors prepared from the melt* –JF
- (AN#33) - As - Arsenic  
Structural and Electronic Properties of Layered Arsenic and Antimony Arsenide, Liangzhi Kou, Yandong Ma, Xin Tan, Thomas Frauenheim, Aijun Du, and Sean Smith  
*J. Phys. Chem. C* **2015**, *119* (12), pp 6918–6922  
DOI: [10.1021/acs.jpcc.5b02096](https://doi.org/10.1021/acs.jpcc.5b02096)  
Publication Date (Web): March 9, 2015  
*Computational study of 2D materials that includes 2D arsenic –GCS*
- (AN#34) - Se - Selenium  
ZIF-67@Se@MnO<sub>2</sub>: A Novel Co-MOF-Based Composite Cathode for Lithium–Selenium Batteries, Wenkai Ye, Weiyang Li, Ke Wang, Weihao Yin, Wenwen Chai, Yi Qu, Yichuan Rui, and Bohejin Tang  
*J. Phys. Chem. C* **2019**, *123* (4), pp 2048–2055  
DOI: [10.1021/acs.jpcc.8b10598](https://doi.org/10.1021/acs.jpcc.8b10598)  
Publication Date (Web): December 25, 2018  
*Selenium is added to a metal–organic-framework as a composite for batteries.* –MZ
- (AN#35) - Br - Bromine  
The Ultraviolet–Visible Absorption Spectrum of Bromine between Room Temperature and 440°, A. A. Passchier, Jerry D. Christian, and Norman W. Gregory  
*J. Phys. Chem.* **1967**, *71* (4), pp 937–942  
DOI: [10.1021/j100863a025](https://doi.org/10.1021/j100863a025)  
Publication Date: March 1967  
*Classical spectroscopy study of Br<sub>2</sub> from the 1960s* –GCS
- (AN#36) - Kr - Krypton  
A Set of Molecular Models for Symmetric Quadrupolar Fluids, Jadran Vrabec, Jürgen Stoll, and Hans Hasse  
*J. Phys. Chem. B* **2001**, *105* (48), pp 12126–12133  
DOI: [10.1021/jp012542o](https://doi.org/10.1021/jp012542o)  
Publication Date (Web): November 2, 2001  
*This paper presents a molecular model for 25 pure fluids including krypton.* –BM
- (AN#37) - Rb - Rubidium  
Cesium and Rubidium Ion Equilibria in Illite Clay, E. Brouwer, B. Baeyens, A. Maes, and A. Cremers  
*J. Phys. Chem.* **1983**, *87* (7), pp 1213–1219  
DOI: [10.1021/j100230a024](https://doi.org/10.1021/j100230a024)  
Publication Date: March 1983  
*Rubidium cations in solutions exhibit similar properties as the alkali cations in neighboring rows of the periodic table, which makes it a challenge to investigate the corresponding ion exchange processes in Illite clays.* –PJ
- (AN#38) - Sr - Strontium  
Nature of Deficiency in Nonstoichiometric Hydroxyapatites. I. Catalytic Activity of Calcium and Strontium Hydroxyapatites, S. J. Joris and C. H. Amberg  
*J. Phys. Chem.* **1971**, *75* (20), pp 3167–3171  
DOI: [10.1021/j100689a024](https://doi.org/10.1021/j100689a024)  
Publication Date: September 1971  
*Well-cited paper detailing the catalytic effects of substituting Sr<sup>2+</sup> for Ca<sup>2+</sup> in hydroxyapatites for dehydration of alcohol* –RD
- (AN#39) - Y - Yttrium  
Mass Spectroscopic and ESR Characterization of Soluble Yttrium-Containing Metallofullerenes YC<sub>82</sub> and Y<sub>2</sub>C<sub>82</sub>, Hisanori Shinohara, Hiroyasu Sato, Yahachi Saito, Masato Ohkohchi, and Yoshinori Ando  
*J. Phys. Chem.* **1992**, *96* (9), pp 3571–3573  
DOI: [10.1021/j100188a004](https://doi.org/10.1021/j100188a004)

Publication Date: April 1992

*Solvent soluble, yttrium-containing fullerenes are produced and characterized by mass spectroscopic analysis.* –SL

(AN#40) - Zr - Zirconium

Adsorption of Ordered Zirconium Phosphonate Multilayer Films on Silicon and Gold Surfaces, Haiwon Lee, Larry J. Kopley, Hun Gi Hong, Sohail Akhter, and Thomas E. Mallouk  
*J. Phys. Chem.* **1988**, 92 (9), pp 2597–2601

DOI: [10.1021/j100320a040](https://doi.org/10.1021/j100320a040)

Publication Date: May 1988

*This was one of the first papers that showed multilayer zirconium phosphonate films can be prepared on silicon and gold substrates via sequential adsorption of their zirconium and phosphonic acid components.* –TG

(AN#41) - Nb - Niobium

The Permeability of Niobium to Hydrogen, D. W. Rudd, D. W. Vose, and S. Johnson

*J. Phys. Chem.* **1962**, 66 (2), pp 351–353

DOI: [10.1021/j100808a038](https://doi.org/10.1021/j100808a038)

Publication Date: February 1962

*The permeability of niobium metal to hydrogen gas was measured at temperature and pressure ranges of 950–1065 °C and 1.1–2.0 atm, respectively, and it was fit to a simple Arrhenius rate expression with an activation energy of 5.2 kcal/mol* –TM

(AN#42) - Mo - Molybdenum

Computational Design of Single-Molybdenum Catalysts for the Nitrogen Reduction Reaction, Qinye Li, Siyao Qiu, Chuangwei Liu, Mingguo Liu, Lizhong He, Xiwang Zhang, and Chenghua Sun

*J. Phys. Chem. C* **2019**, 123 (4), pp 2347–2352

DOI: [10.1021/acs.jpcc.8b11509](https://doi.org/10.1021/acs.jpcc.8b11509)

Publication Date (Web): January 4, 2019

*Computational design of single-molybdenum catalysts for nitrogen reduction offering overall overpotentials lower than 0.60 V* –VB

(AN#43) - Tc - Technetium

Report on the Occurrence of Technetium on the Earth's Crust, G. E. Boyd, and Q. V. Larson

*J. Phys. Chem.* **1956**, 60 (6), pp 707–715

DOI: [10.1021/j150540a002](https://doi.org/10.1021/j150540a002)

Publication Date: June 1956

*Hard to prove a negative, but this paper attempts to demonstrate the nonexistence of terrestrial Tc through analysis of geologic samples most likely to contain the element.* –WFS

(AN#44) - Ru - Ruthenium

Excited States of Mixed Ligand Chelates of Ruthenium(II) and Rhodium(III), G. A. Crosby and W. H. Elfring Jr.

*J. Phys. Chem.* **1976**, 80 (20), pp 2206–2211

DOI: [10.1021/j100561a016](https://doi.org/10.1021/j100561a016)

Publication Date: September 1976

*It has the charming advantage that it was part of a "discussion" so the authors answer questions about it at the end of the paper!* –CM

(AN#45) - Rh - Rhodium

Infrared Studies of Carbon Monoxide Chemisorbed on Rhodium, C. Yang and Carl W. Garland

*J. Phys. Chem.* **1957**, 61 (11), pp 1504–1512

DOI: [10.1021/j150557a013](https://doi.org/10.1021/j150557a013)

Publication Date: November 1957

*Infrared transmission spectrum of CO on Rh is described as involving three surface species.* –XY

(AN#46) - Pd - Palladium

Diffusion and Solubility of Hydrogen in Palladium and Palladium–Silver Alloys, Gerhard L. Holleck

*J. Phys. Chem.* **1970**, 74 (3), pp 503–511

DOI: [10.1021/j100698a005](https://doi.org/10.1021/j100698a005)

Publication Date: February 1970

*Pd is a key hydrogenation catalyst and this paper first measures the H diffusion and solubility in Pd and Pd–Ag.* –ZPL

(AN#47) - Ag - Silver

The Optical Properties of Metal Nanoparticles: The Influence of Size, Shape, and Dielectric Environment, K. Lance Kelly, Eduardo Coronado, Lin Lin Zhao, and George C. Schatz

*J. Phys. Chem. B* **2003**, 107 (3), pp 668–677

DOI: [10.1021/jp026731y](https://doi.org/10.1021/jp026731y)

Publication Date (Web): December 21, 2002

*Feature Article describing the progress made up to 2003 on the theory of nanoparticle optical properties, with emphasis on light scattering from particles of arbitrary shape in complex environments, and discussing spherical and triangular silver particles as an example of particular interest* –FZ

(AN#48) - Cd - Cadmium

Two-Dimensional Electronic Spectroscopy Unravels sub-100 fs Electron and Hole Relaxation Dynamics in Cd-Chalcogenide Nanostructures, Tatjana Stoll, Federico Branchi, Julien Réhault, Francesco Scotognella, Francesco Tassone, Ilka Kriegel, and Giulio Cerullo

*J. Phys. Chem. Lett.* **2017**, 8 (10), pp 2285–2290

DOI: [10.1021/acs.jpcclett.7b00682](https://doi.org/10.1021/acs.jpcclett.7b00682)

Publication Date (Web): May 3, 2017

*Two-Dimensional electronic spectroscopy unravels sub-100 fs electron and hole relaxation dynamics in Cd-chalcogenide nanostructures* –GS

(AN#49) - In - Indium

ITO Interface Modifiers Can Improve  $V_{OC}$  in Polymer Solar Cells and Suppress Surface Recombination, Kristina M. Knesting, Huanxin Ju, Cody W. Schlenker, Anthony J. Giordano, Andres Garcia, O'Neil L. Smith, Dana C. Olson, Seth R. Marder, and David S. Ginger

*J. Phys. Chem. Lett.* **2013**, 4 (23), pp 4038–4044

DOI: [10.1021/jz4021525](https://doi.org/10.1021/jz4021525)

Publication Date (Web): November 8, 2013

*Linear dependence of the open-circuit voltage of organic photovoltaic devices on the modified indium tin oxide (ITO) work function* –JB

(AN#50) - Sn - Tin

Capped Semiconductor Colloids. Synthesis and Photoelectrochemical Behavior of TiO<sub>2</sub> Capped SnO<sub>2</sub> Nanocrystallites, Idriss Bedja and Prashant V. Kamat

*J. Phys. Chem.* **1995**, 99 (22), pp 9182–9188

DOI: [10.1021/j100022a035](https://doi.org/10.1021/j100022a035)

Publication Date: June 1995

*An investigation on the effect of TiO<sub>2</sub> capping on SnO<sub>2</sub> colloidal nanocrystallites for photoelectrochemical applications* –JZ

(AN#51) - Sb - Antimony

Stability of Free Intermetallic Compound Clusters: Lead/Antimony and Bismuth/Antimony, D. Schild, R. Pflaum, K. Sattler, and E. Recknagel

*J. Phys. Chem.* **1987**, 91 (10), pp 2649–2653

DOI: [10.1021/j100294a037](https://doi.org/10.1021/j100294a037)

Publication Date: May 1987

*In the gas phase, antimony atoms form tetrahedra, and this is the starting point for the understanding of lead–antimony and bismuth–antimony clusters.* –NS

(AN#52) - Te - Tellurium

Intrinsic Piezoelectricity in Two-Dimensional Materials, Karel-Alexander N. Duerloo, Mitchell T. Ong, and Evan J. Reed

*J. Phys. Chem. Lett.* **2012**, 3 (19), pp 2871–2876

DOI: [10.1021/jz3012436](https://doi.org/10.1021/jz3012436)

Publication Date (Web): September 17, 2012

*Tellurium piezoelectricity of two-dimensional  $\text{MoTe}_2$  and  $\text{WTe}_2$  is predicted.* (highly cited paper). –OP

(AN#53) - I - Iodine

Photodissociation and Geminate Recombination Dynamics of Iodine ( $\text{I}_2^-$ ) in Mass-Selected Iodine–Carbon Dioxide ( $\text{I}_2^-(\text{CO}_2)_n$ ) Cluster Ions, John M. Papanikolas, James R. Gord, Nancy E. Levinger, Douglas Ray, Vasil Vorsa, and W. C. Lineberger

*J. Phys. Chem.* **1991**, 95 (21), pp 8028–8040

DOI: [10.1021/j100174a008](https://doi.org/10.1021/j100174a008)

Publication Date: October 1991

*$\text{I}_2^-(\text{CO}_2)_n$  cluster photodissociation, geminate recombination* –TZ

(AN#54) - Xe - Xenon

Distribution and Dynamic Properties of Xenon Dissolved in the Ionic Smectic Phase of  $[\text{C}_{16}\text{mim}][\text{NO}_3]$ : MD Simulation and Theoretical Model, Diego Frezzato and Giacomo Saielli

*J. Phys. Chem. B* **2016**, 120 (9), pp 2578–2585

DOI: [10.1021/acs.jpcc.5b12470](https://doi.org/10.1021/acs.jpcc.5b12470)

Publication Date (Web): February 5, 2016

*Macroscopic transport coefficients are calculated for xenon in an ionic liquid, as it diffuses across the ionic layers of the smectic phase from a hydrophobic, alkyl environment.* –TC

(AN#55) - Cs - Cesium

Many-Body Effects Determine the Local Hydration Structure of  $\text{Cs}^+$  in Solution, Debbie Zhuang, Marc Riera, Gregory K. Schenter, John L. Fulton, and Francesco Paesani

*J. Phys. Chem. Lett.* **2019**, 10 (3), pp 406–412

DOI: [10.1021/acs.jpcclett.8b03829](https://doi.org/10.1021/acs.jpcclett.8b03829)

Publication Date (Web): January 10, 2019

*MD simulations of  $\text{Cs}^+$  hydration demonstrate the importance of polarization effects.* –HZ

(AN#56) - Ba - Barium

Structures of the Ferroelectric Phases of Barium Titanate, G. H. Kwei, A. C. Lawson, S. J. L. Billinge, and S. W. Cheong

*J. Phys. Chem.* **1993**, 97 (10), pp 2368–2377

DOI: [10.1021/j100112a043](https://doi.org/10.1021/j100112a043)

Publication Date: March 1993

*Structure of ferroelectric phases of  $\text{BaTiO}_3$  determined by Rietveld refinement using powder diffraction data collected at a spallation neutron source* –AG

(AN#57) - La - Lanthanum

Fullerenes with Metals Inside, Yan Chai, Ting Guo, Changming Jin, Robert E. Haufler, L. P. Felipe Chibante, Jan Fure, Lihong Wang, J. Michael Alford, and Richard E. Smalley

*J. Phys. Chem.* **1991**, 95 (20), pp 7564–7568

DOI: [10.1021/j100173a002](https://doi.org/10.1021/j100173a002)

Publication Date: October 1991

*Letter reports the observation of fullerenes with single lanthanum atoms caged inside* –ASM

(AN#58) - Ce - Cerium

Direct Evidence for Hydroxyl Radical Scavenging Activity of Cerium Oxide Nanoparticles, Ying Xue, Qingfen Luan, Dan Yang, Xin Yao, and Kebin Zhou

*J. Phys. Chem. C* **2011**, 115 (11), pp 4433–4438

DOI: [10.1021/jp109819u](https://doi.org/10.1021/jp109819u)

Publication Date (Web): March 1, 2011

*Studies the mechanism of antioxidant behavior of cerium oxide nanoparticles* –AY

(AN#59) - Pr - Praseodymium

The Effect of  $\text{LiClO}_4$ ,  $\text{LiCl}$ , and  $\text{LiBr}$  on the Polarographic Behavior and Ultraviolet Spectrum of Praseodymium(III) in Ethanol, Sheldon H. Cohen, Reynold T. Iwamoto, and Jacob Kleinberg

*J. Phys. Chem.* **1963**, 67 (6), pp 1275–1278

DOI: [10.1021/j100800a027](https://doi.org/10.1021/j100800a027)

Publication Date: June 1963

*Paper on effects of different anions on Pr(III) in solution* –BS

(AN#60) - Nd - Neodymium

Enhanced Emission of Deuterated Tris(hexafluoroacetylacetonato)neodymium(III) Complex in Solution by Suppression of Radiationless Transition via Vibrational Excitation, Yasuchika Hasegawa, Yasutaka Kimura, Kei Murakoshi, Yuji Wada, Jeong-Ho Kim, Nobuaki Nakashima, Tatsuhiko Yamanaka, and Shozo Yanagida

*J. Phys. Chem.* **1996**, 100 (24), pp 10201–10205

DOI: [10.1021/jp960290z](https://doi.org/10.1021/jp960290z)

Publication Date (Web): June 13, 1996

*A study of the impact of various deuterated solvents on a  $\text{Nd}^{3+}$  complex (150 citations)* –DC

(AN#61) - Pm - Promethium

Calorimetric Determination of the Mean  $\beta$ -Energy and Half-Life of Promethium-147, E. J. Wheelwright, D. M. Fleming, and F. P. Roberts

*J. Phys. Chem.* **1965**, 69 (4), pp 1220–1223

DOI: [10.1021/j100888a021](https://doi.org/10.1021/j100888a021)

Publication Date: April 1965

*The authors determine the mean  $\beta$ -particle energy and the half-life of promethium 147.* –EW

(AN#62) - Sm - Samarium

The Near Infrared Transitions of the Trivalent Lanthanides in Solution. I. Praseodymium(III), Neodymium(III), Samarium(III), and Europium(III) Ions, W. T. Carnall, D. M. Gruen, and R. L. McBeth

*J. Phys. Chem.* **1962**, 66 (11), pp 2159–2164

DOI: [10.1021/j100817a020](https://doi.org/10.1021/j100817a020)

Publication Date: November 1962

*Report of NIR transitions of molten trivalent lanthanides* –FG

(AN#63) - Eu - Europium

Hierarchical Emergence and Dynamic Control of Chirality in a Photoresponsive Dinuclear Complex, Yuichiro Hashimoto,

Takuya Nakashima, Miku Yamada, Junpei Yuasa, Gwénaél Rapenne, and Tsuyoshi Kawai

*J. Phys. Chem. Lett.* **2018**, 9 (9), pp 2151–2157

DOI: [10.1021/acs.jpcllett.8b00690](https://doi.org/10.1021/acs.jpcllett.8b00690)

Publication Date (Web): April 11, 2018

*Hierarchical emergence and dynamic control of chirality in a photoresponsive dinuclear complex* –GS

(AN#64) - Gd - Gadolinium

Water-Exchange, Electronic Relaxation, and Rotational Dynamics of the MRI Contrast Agent [Gd(DTPA-BMA)(H<sub>2</sub>O)] in Aqueous Solution: A Variable Pressure, Temperature, and Magnetic Field Oxygen-17 NMR Study, Gabriel Gonzalez, D. Hugh Powell, Veronique Tissieres, and Andre E. Merbach

*J. Phys. Chem.* **1994**, 98 (1), pp 53–59

DOI: [10.1021/j100052a010](https://doi.org/10.1021/j100052a010)

<sup>17</sup>O NMR longitudinal and transverse relaxation rates and chemical shifts were measured for a gadolinium complex as a measure of the efficacy as a magnetic resonance imaging contrast agent. –GEMS

(AN#65) - Tb - Terbium

Rare Earths. II. A Mass Spectrometric Determination of the Heats of Sublimation (or Vaporization) of Neodymium, Praseodymium, Gadolinium, Terbium, Dysprosium, Holmium, Erbium and Lutetium, David White, Patrick N. Walsh, Harold W. Goldstein, and David F. Dever

*J. Phys. Chem.* **1961**, 65 (8), pp 1404–1409

DOI: [10.1021/j100826a030](https://doi.org/10.1021/j100826a030)

Publication Date: August 1961

*Initial measurement of mass spectrometry determination of heat of sublimation of seven rare earth metals including terbium, holmium, erbium, and lutetium* –GL

(AN#66) - Dy - Dysprosium

Synthesis, Structure, Photoluminescence, and Electroluminescence Properties of a New Dysprosium Complex, Zhe-Feng Li, Liang Zhou, Jiang-Bo Yu, Hong-Jie Zhang, Rui-Ping Deng, Ze-Ping Peng, and Zhi-Yong Guo

*J. Phys. Chem. C* **2007**, 111 (5), pp 2295–2300

DOI: [10.1021/jp064749t](https://doi.org/10.1021/jp064749t)

Publication Date (Web): January 17, 2007

*A new dysprosium complex was synthesized, and its structural and photophysical properties were evaluated. The energy transfer mechanism between the ligand and central Dy<sup>3+</sup> ion is discussed, and a series of electroluminescent devices were built. Emission at both yellow (572 nm) and blue (480 nm) wavelengths was observed. Appropriate choice of the yellow/blue intensity ratio is proposed to be tunable to achieve white luminescent emission.* –GRG

(AN#67) - Ho - Holmium

Amplifying Excitation-Power Sensitivity of Photon Upconversion in a NaYbF<sub>4</sub>:Ho Nanostructure for Direct Visualization of Electromagnetic Hotspots, Bing Chen, Yong Liu, Yao Xiao, Xian Chen, Yang Li, Mingyu Li, Xvsheng Qiao, Xianping Fan, and Feng Wang

*J. Phys. Chem. Lett.* **2016**, 7 (23), pp 4916–4921

DOI: [10.1021/acs.jpcllett.6b02210](https://doi.org/10.1021/acs.jpcllett.6b02210)

Publication Date (Web): November 15, 2016

*Holmium ion doped nanoparticles produce upconverted luminescence that can be used for imaging hot-spots in plasmonic materials.* –GVH

(AN#68) - Er - Erbium

Highly Efficient Multicolor Up-Conversion Emissions and Their Mechanisms of Monodisperse NaYF<sub>4</sub>:Yb,Er Core and Core/Shell-Structured Nanocrystals, Hao-Xin Mai, Ya-Wen Zhang, Ling-Dong Sun, and Chun-Hua Yan

*J. Phys. Chem. C* **2007**, 111 (37), pp 13721–13729

DOI: [10.1021/jp073920d](https://doi.org/10.1021/jp073920d)

Publication Date (Web): August 24, 2007

*Synthesis of highly efficient erbium doped phosphors and their mechanism of efficient up-conversion* –HF

(AN#69) - Tm - Thulium

The Electronic and Vibrational Structure of Endohedral Tm<sub>3</sub>N@C<sub>80</sub> (I) Fullerene - Proof of an Encaged Tm<sup>3+</sup>, Matthias Krause, Xianjie Liu, Joanna Wong, Thomas Pichler, Martin Knupfer, and Lothar Dunsch

*J. Phys. Chem. A* **2005**, 109 (32), pp 7088–7093

DOI: [10.1021/jp0525080](https://doi.org/10.1021/jp0525080)

Publication Date (Web): July 23, 2005

*Characterization of encaged Tm<sup>3+</sup> in C<sub>80</sub> fullerene* –HG

(AN#70) - Yb - Ytterbium

Visible Upconversion in Rare Earth Ion-Doped Gd<sub>2</sub>O<sub>3</sub> Nanocrystals, Hai Guo, Ning Dong, Min Yin, Weiping Zhang, Liren Lou, and Shangda Xia

*J. Phys. Chem. B* **2004**, 108 (50), pp 19205–19209

DOI: [10.1021/jp048072q](https://doi.org/10.1021/jp048072q)

Publication Date (Web): November 20, 2004

*A landmark paper in the rare-earth upconversion literature* –JF

(AN#71) - Lu - Lutetium

Electrical and Magnetic Properties of Liquid Crystalline Molecular Materials: Lithium and Lutetium Phthalocyanine Derivatives, Z. Belarbi, C. Sirlin, J. Simon, and Jean Jacques Andre

*J. Phys. Chem.* **1989**, 93 (24), pp 8105–8110

DOI: [10.1021/j100361a026](https://doi.org/10.1021/j100361a026)

Publication Date: November 1989

*Double decker lutetium phthalocyanine based liquid crystalline molecular materials with interesting properties and applications* –KB

(AN#72) - Hf - Hafnium

Atomic Layer Deposition of Hafnium Oxide from Tetrakis(ethylmethylamino)hafnium and Water Precursors, Wei Chen, Qing-Qing Sun, Min Xu, Shi-Jin Ding, David Wei Zhang, and Li-Kang Wang

*J. Phys. Chem. C* **2007**, 111 (17), pp 6495–6499

DOI: [10.1021/jp070362u](https://doi.org/10.1021/jp070362u)

Publication Date (Web): April 6, 2007

*Thermodynamics of hafnium calculated to predict atomic layer deposition processes.* –MZ

(AN#73) - Ta - Tantalum

Quantum-Sized PbS, CdS, Ag<sub>2</sub>S, Sb<sub>2</sub>S<sub>3</sub>, and Bi<sub>2</sub>S<sub>3</sub> Particles as Sensitizers for Various Nanoporous Wide-Bandgap Semiconductors, R. Vogel, P. Hoyer, and H. Weller

*J. Phys. Chem.* **1994**, 98 (12), pp 3183–3188

DOI: [10.1021/j100063a022](https://doi.org/10.1021/j100063a022)

Publication Date: March 1994

*Paper investigates the sensitization of nanoporous oxides (including tantalum oxide) by quantum-sized metal sulfides.* –BM

(AN#74) - W - Tungsten

Photoelectrochemistry of Quantized Tungsten Trioxide Colloids: Electron Storage, Electrochromic, and Photoelectrochromic Effects, Idriss Bedja, Surat Hotchandani, and Prashant V. Kamat

*J. Phys. Chem.* **1993**, 97 (42), pp 11064–11070

DOI: [10.1021/j100144a027](https://doi.org/10.1021/j100144a027)

Publication Date: October 1993

*Tungsten oxide (WO<sub>3</sub>) colloidal particles have been shown to act as electron-relay systems with potential for construction of solar energy conversion and storage devices.* –PJ

(AN#75) - Re - Rhenium

Surface Catalytic Sites Prepared from [HRe(CO)<sub>5</sub>] and [H<sub>3</sub>Re<sub>3</sub>(CO)<sub>12</sub>]: Mononuclear, Trinuclear, and Metallic Rhenium Catalysts Supported on Magnesia, P. S. Kirilin, F. B. M. van Zon, D. C. Koningsberger, and Bruce C. Gates

*J. Phys. Chem.* **1990**, 94 (22), pp 8439–8450

DOI: [10.1021/j100385a017](https://doi.org/10.1021/j100385a017)

Publication Date: November 1990

*Spectroscopic and structural characterization of various heterogeneous Re catalysts on MgO, providing a better understanding of catalytic activity* –RD

(AN#76) - Os - Osmium

Application of the Energy Gap Law to Excited-State Decay of Osmium(II)–Polypyridine Complexes: Calculation of Relative Nonradiative Decay Rates from Emission Spectral Profiles, Edward M. Kober, Jonathan V. Caspar, Richard S. Lumpkin, and Thomas J. Meyer

*J. Phys. Chem.* **1986**, 90 (16), pp 3722–3734

DOI: [10.1021/j100407a046](https://doi.org/10.1021/j100407a046)

Publication Date: July 1986

*Radiative and nonradiative decay rates of the metal-to-ligand charge-transfer excited states for osmium complexes scale in accordance with the Einstein law for spontaneous emission and the energy gap law, respectively* –SL

(AN#77) - Ir - Iridium

A High Yield Synthesis of Ligand-Free Iridium Oxide Nanoparticles with High Electrocatalytic Activity, Yixin Zhao, Emil A. Hernandez-Pagan, Nella M. Vargas-Barbosa, Jennifer L. Dysart, and Thomas E. Mallouk

*J. Phys. Chem. Lett.* **2011**, 2 (5), pp 402–406

DOI: [10.1021/jz200051c](https://doi.org/10.1021/jz200051c)

Publication Date (Web): February 7, 2011

*Synthesis and characterization of IrO<sub>x</sub> nanoparticles, which are highly active for water oxidation* –GCS

(AN#78) - Pt - Platinum

Platinum Black Catalysts. I, G. B. Taylor, G. B. Kistiakowsky, and J. H. Perry

*J. Phys. Chem.* **1930**, 34 (4), pp 748–752

DOI: [10.1021/j150310a007](https://doi.org/10.1021/j150310a007)

Publication Date: January 1929

*Platinum black was prepared by three methods, and its catalytic activity to several oxidation and reduction reactions was correlated with particle size, with the smaller particle size showing higher catalytic activity.* –TM

(AN#79) - Au - Gold

Adsorption and Surface-Enhanced Raman of Dyes on Silver and Gold Sols, P. C. Lee and D. Meisel

*J. Phys. Chem.* **1982**, 86 (17), pp 3391–3395

DOI: [10.1021/j100214a025](https://doi.org/10.1021/j100214a025)

Publication Date: August 1982

*Classic paper on colloidal gold (and silver)* –CM

(AN#80) - Hg - Mercury

Mercury Drop “Attacks” an Oxidant Crystal, Satoshi Nakata, Haruhisa Komoto, Kumiko Hayashi, and Michael Menzinger

*J. Phys. Chem. B* **2000**, 104 (15), pp 3589–3593

DOI: [10.1021/jp9936502](https://doi.org/10.1021/jp9936502)

Publication Date (Web): March 3, 2000

*A mercury drop “attacks” a K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> crystal placed ~10 mm apart. The circular Hg drop began to elongate and to move toward the crystal with a shape and motion related to the anisotropy of the interfacial tension.* –VB

(AN#81) - Tl - Thallium

Viscosity and Self-Diffusion of Liquid Thallium from Its Melting Point to About 1300 K, J. A. Cahill and A. V. Grosse

*J. Phys. Chem.* **1965**, 69 (2), pp 518–521

DOI: [10.1021/j100886a026](https://doi.org/10.1021/j100886a026)

Publication Date: February 1965

*Great example of how physical property measurements were at one time an important part of the journal, here in the context of a less common element* –WFS

(AN#82) - Pb - Lead

Interband and Intraband Optical Studies of PbSe Colloidal Quantum Dots, Brian L. Wehrenberg, Congjun Wang, and Philippe Guyot-Sionnest

James Franck Institute, The University of Chicago, 5640 South Ellis Avenue, Chicago, Illinois 60637

*J. Phys. Chem. B* **2002**, 106 (41), pp 10634–10640

DOI: [10.1021/jp021187e](https://doi.org/10.1021/jp021187e)

Publication Date (Web): September 24, 2002

*Interband and intraband optical studies of PbSe colloidal quantum dots* –XY

(AN#83) - Bi - Bismuth

The Bismuth–Bismuth Tribromide and Bismuth–Bismuth Triiodide Systems, S. J. Yosim, L. D. Ransom, R. A. Sallach, and L. E. Topol

*J. Phys. Chem.* **1962**, 66 (1), pp 28–31

DOI: [10.1021/j100807a006](https://doi.org/10.1021/j100807a006)

Publication Date: January 1962

*Paper concerned with industrial applications* –CM

(AN#84) - Po - Polonium

The Preparation and Identification of Some Intermetallic Compounds of Polonium, W. G. Witteman, A. L. Giorgi, and D. T. Vier

*J. Phys. Chem.* **1960**, 64 (4), pp 434–440

DOI: [10.1021/j100833a014](https://doi.org/10.1021/j100833a014)

Publication Date: April 1960

*The finding of Po-forming solid alloy with other elements* –ZPL

(AN#85) - At - Astatine

Astatine Standard Redox Potentials and Speciation in Acidic Medium, J. Champion, C. Alliot, E. Renault, B. M. Mokili, M. Chérel, N. Galland, and G. Montavon

*J. Phys. Chem. A* **2010**, 114 (1), pp 576–582

DOI: [10.1021/jp9077008](https://doi.org/10.1021/jp9077008)

Publication Date (Web): December 16, 2009



A combined experimental and theoretical study that shows that At can be present in aqueous solution in three forms, namely,  $\text{At}^-$ ,  $\text{At}^+$ , and  $\text{AtO}^+$ , in the 1–2 pH range, and that the oxidation state 0 cannot exist –FZ

(AN#86) - Rn - Radon

Adsorption of Radon on Metal Surfaces: A Model Study for Chemical Investigations of Elements 112 and 114, R. Eichler and M. Schädel

*J. Phys. Chem. B* **2002**, *106* (21), pp 5413–5420

DOI: [10.1021/jp015553q](https://doi.org/10.1021/jp015553q)

Publication Date (Web): April 27, 2002

There are more highly cited papers, but they usually include radon with a bunch of other noble gases. –CM

(AN#87) - Fr - Francium

First Experimentally Determined Thermodynamic Values of Francium: Hydration Energy, Energy of Partitioning, and Thermodynamic Radius, Lætitia H. Delmau, Jérôme Moine, Saed Mirzadeh, and Bruce A. Moyer

*J. Phys. Chem. B* **2013**, *117* (31), pp 9258–9261

DOI: [10.1021/jp401880f](https://doi.org/10.1021/jp401880f)

Publication Date (Web): July 12, 2013

Experimental measurement of  $\text{Fr}^+$  ionic radius resulted in a smaller radius than previously thought. –GCS

(AN#88) - Ra - Radium

Structures and Heats of Formation of Simple Alkaline Earth Metal Compounds II: Fluorides, Chlorides, Oxides, and Hydroxides for Ba, Sr, and Ra, Monica Vasiliu, J. Grant Hill, Kirk A. Peterson, and David A. Dixon

*J. Phys. Chem. A* **2018**, *122* (1), pp 316–327

DOI: [10.1021/acs.jpca.7b09056](https://doi.org/10.1021/acs.jpca.7b09056)

Publication Date (Web): December 14, 2017

Relativistic coupled cluster theory has been used to calculate heats of formation of compounds of Ra. –KB

(AN#89) - Ac - Actinium

Capped Semiconductor Colloids. Synthesis and Photoelectrochemical Behavior of  $\text{TiO}_2$  Capped  $\text{SnO}_2$  Nanocrystallites, Idriss Bedja and Prashant V. Kamat

*J. Phys. Chem.* **1995**, *99* (22), pp 9182–9188

DOI: [10.1021/j100022a035](https://doi.org/10.1021/j100022a035)

Publication Date: June 1995

The volatility of actinium was measured through volatilization experiments at high temperature. –JZ

(AN#90) - Th - Thorium

Making and Breaking Bonds in the Solid State: The Thorium Chromium Silicide ( $\text{ThCr}_2\text{Si}_2$ ) Structure, Roald Hoffmann and Chong Zheng

*J. Phys. Chem.* **1985**, *89* (20), pp 4175–4181

DOI: [10.1021/j100266a007](https://doi.org/10.1021/j100266a007)

Publication Date: September 1985

Highly cited feature article by Roald Hoffman on crystal structures for which  $\text{ThCr}_2\text{Si}_2$  is a prototype –JF

(AN#91) - Pa - Protactinium

Theoretical Study on Molecular Property of Protactinium(V) and Uranium(VI) Oxocations: Why Does Protactinium(V) Form Monooxo Cations in Aqueous Solution? Takashi Toraishi, Takao Tsuneda, and Satoru Tanaka

*J. Phys. Chem. A* **2006**, *110* (49), pp 13303–13309

DOI: [10.1021/jp0641435](https://doi.org/10.1021/jp0641435)

Publication Date (Web): November 15, 2006

Electronic structure calculations of the  $\text{Pa(V)}$  oxocation in aqueous solution clearly support from an energetic point of view the experimental result that monooxo protactinyl cation,  $\text{PaO}_3^+$  is a preferable species for  $\text{Pa(V)}_{\text{aq}}$  –PJ

(AN#92) - U - Uranium

The Uranium–Oxygen System:  $\text{UO}_{2.5}$  to  $\text{U}_3\text{O}_8$ , H. R. Hoekstra, S. Siegel, L. H. Fuchs, and J. J. Katz

*J. Phys. Chem.* **1955**, *59* (2), pp 136–138

DOI: [10.1021/j150524a010](https://doi.org/10.1021/j150524a010)

Publication Date: February 1955

Uranium–oxygen system:  $\text{UO}_{2.5}$  to  $\text{U}_3\text{O}_8$  –TZ

(AN#93) - U - Neptunium

Measurement of the Absorption Spectra of Neptunium Ions in Heavy Water Solution from 0.35 to 1.85  $\mu$ , W. C. Waggener

*J. Phys. Chem.* **1958**, *62* (3), pp 382–383

DOI: [10.1021/j150561a050](https://doi.org/10.1021/j150561a050)

Publication Date: March 1958

Examines the adsorption spectrum of neptunium in heavy water –AG

(AN#94) - Pu - Plutonium

The Kinetics of the Reaction between Plutonium(VI) and Iron(II), T. W. Newton and F. B. Baker

*J. Phys. Chem.* **1963**, *67* (7), pp 1425–1432

DOI: [10.1021/j100801a005](https://doi.org/10.1021/j100801a005)

Publication Date: July 1963

Classic 1962 study of rates and thermodynamics of the oxidation–reduction reaction of plutonium and iron –ASM

(AN#95) - Am - Americium

Americium Organometallic Ions Produced by Laser Ablation of  $\text{AmO}_2$  in Polyimide, John K. Gibson

*J. Phys. Chem. A* **1998**, *102* (24), pp 4501–4508

DOI: [10.1021/jp981145j](https://doi.org/10.1021/jp981145j)

Publication Date (Web): May 20, 1998

Americium organometallic ions produced by laser ablation of  $\text{AmO}_2$  in polyimide –AY

(AN#96) - Cm - Curium

Hydration Shell Structure and Dynamics of Curium(III) in Aqueous Solution: First Principles and Empirical Studies, Raymond Atta-Fynn, Eric J. Bylaska, Gregory K. Schenter, and Wibe A. de Jong

*J. Phys. Chem. A* **2011**, *115* (18), pp 4665–4677

DOI: [10.1021/jp201043f](https://doi.org/10.1021/jp201043f)

Publication Date (Web): April 18, 2011

Simulation paper on the structure of  $\text{Cm(III)}$  in aqueous solution –BS

(AN#97) - Bk - Berkelium

Electron-Transfer Spectra and the II–III Oxidation Potentials of Some Lanthanide and Actinide Halides in Solution, Leonard J. Nugent, R. D. Baybarz, and J. L. Burnett

*J. Phys. Chem.* **1969**, *73* (4), pp 1177–1178

DOI: [10.1021/j100724a084](https://doi.org/10.1021/j100724a084)

Publication Date: April 1969

Includes calculated absorption maximum and oxidation potential of  $\text{BkBr}$  –DC

- (AN#98) - Cf - Californium  
Radiolysis of 0.4 M Sulfuric Acid Solutions with Fission Fragments from Dissolved Californium-252. Estimated Yields of Radical and Molecular Products that Escape Reactions in Fission Fragment Tracks, Ned E. Bibler  
*J. Phys. Chem.* **1975**, *79* (19), pp 1991–1995  
DOI: [10.1021/j100586a002](https://doi.org/10.1021/j100586a002)  
Publication Date: September 1975  
*A study of the radiolysis of sulfuric acid solution, with and without Fe<sup>2+</sup> and Ce<sup>4+</sup> ions, using dissolved californium-252* –EW
- (AN#99) - Es - Einsteinium  
Intramolecular Energy Transfer and Sensitized Luminescence in Actinide(III)  $\beta$ -Diketone Chelates, Leonard J. Nugent, J. L. Burnett, R. D. Baybarz, George Knoll Werner, S. P. Tanner, J. R. Tarrant, and O. L. Keller, Jr.  
*J. Phys. Chem.* **1969**, *73* (5), pp 1540–1549  
DOI: [10.1021/j100725a060](https://doi.org/10.1021/j100725a060)  
Publication Date: May 1969  
*First measurements of Es(III) chelate lifetimes from the transuranium laboratory at ORNL* –FG
- (AN#100) - Fm - Fermium  
Electron-Transfer Spectra and the II–III Oxidation Potentials of Some Lanthanide and Actinide Halides in Solution, Leonard J. Nugent, R. D. Baybarz, and J. L. Burnett  
*J. Phys. Chem.* **1969**, *73* (4), pp 1177–1178  
DOI: [10.1021/j100724a084](https://doi.org/10.1021/j100724a084)  
Publication Date: April 1969  
*Calculated oxidation potential (II–III) and lowest charge-transfer band for a Fermium bromide.* –GEMS
- (AN#101) - Md - Mendeleevium  
Role of Atomic Electronics in f-Element Bond Formation: Bond Energies of Lanthanide and Actinide Oxide Molecules, John K. Gibson  
*J. Phys. Chem. A* **2003**, *107* (39), pp 7891–7899  
DOI: [10.1021/jp035003n](https://doi.org/10.1021/jp035003n)  
Publication Date (Web): August 22, 2003  
*This paper makes estimates of the bond dissociation enthalpies of all the actinide monoxides.* –GCS
- (AN#102) - No - Nobelium  
Role of Atomic Electronics in f-Element Bond Formation: Bond Energies of Lanthanide and Actinide Oxide Molecules, John K. Gibson  
*J. Phys. Chem. A* **2003**, *107* (39), pp 7891–7899  
DOI: [10.1021/jp035003n](https://doi.org/10.1021/jp035003n)  
Publication Date (Web): August 22, 2003  
*The bond dissociation energy of NoO cannot be estimated with confidence.* –GCS
- (AN#103) - Lr - Lawrencium  
Redox Reactions for Group 5 Elements, Including Element 105, in Aqueous Solutions, G. V. Ionova, V. Pershina, E. Johnson, B. Fricke, and M. Schaedel  
*J. Phys. Chem.* **1992**, *96* (26), pp 11096–11101  
DOI: [10.1021/j100205a086](https://doi.org/10.1021/j100205a086)  
Publication Date: December 1992  
*Calculation of ionization potentials using the multiconfiguration Dirac–Fock method, showing that the maximum oxidation state of Lr is more stable than the higher mass group 5 elements* –GVH
- (AN#104) - Rf - Rutherfordium  
Total Energy Calculations of RfCl<sub>4</sub> and Homologues in the Framework of Relativistic Density Functional Theory, S. Varga, B. Fricke, M. Hirata, T. Baştuğ, V. Pershina, and S. Fritzsche  
*J. Phys. Chem. A* **2000**, *104* (27), pp 6495–6498  
DOI: [10.1021/jp993980m](https://doi.org/10.1021/jp993980m)  
Publication Date (Web): June 16, 2000  
*Demonstration that a four-component, fully relativistic density functional method could provide accurate values for the formation and binding energies of RfCl<sub>4</sub>* –HF
- (AN#105) - Db - Dubnium  
Thermochemical Characterization of Seaborgium Compounds in Gas Adsorption Chromatography, B. Eichler, A. Türler, and H. W. Gäggeler  
*J. Phys. Chem. A* **1999**, *103* (46), pp 9296–9306  
DOI: [10.1021/jp9917751](https://doi.org/10.1021/jp9917751)  
Publication Date (Web): October 30, 1999  
*Dubnium is mentioned in this paper, but no experimental data are reported.* –HG
- (AN#106) - Sg - Seaborgium  
Ionization Potentials of Seaborgium, E. Johnson, V. Pershina, and B. Fricke  
*J. Phys. Chem. A* **1999**, *103* (42), pp 8458–8462  
DOI: [10.1021/jp9903211](https://doi.org/10.1021/jp9903211)  
Publication Date (Web): October 4, 1999  
*This is the first paper to attempt to calculate the ionization potentials of seaborgium, which was officially only 2 years old at the time.* –JF
- (AN#107) - Bh - Bohrium  
On the Stability and Volatility of Group 8 Tetroxides, MO<sub>4</sub> (M = Ruthenium, Osmium, and Hassium (Z = 108)), Christoph E. Düllmann, Bernd Eichler, Robert Eichler, Heinz W. Gäggeler, and Andreas Türle  
*J. Phys. Chem. B* **2002**, *106* (26), pp 6679–6684  
DOI: [10.1021/jp0257146](https://doi.org/10.1021/jp0257146)  
Publication Date (Web): June 8, 2002  
*Bohrium is briefly mentioned in a study that mostly refers to Hs.* –KB
- (AN#108) - Hs - Hassium  
On the Stability and Volatility of Group 8 Tetroxides, MO<sub>4</sub> (M = Ruthenium, Osmium, and Hassium (Z = 108)), Christoph E. Düllmann, Bernd Eichler, Robert Eichler, Heinz W. Gäggeler, and Andreas Türle  
*J. Phys. Chem. B* **2002**, *106* (26), pp 6679–6684  
DOI: [10.1021/jp0257146](https://doi.org/10.1021/jp0257146)  
Publication Date (Web): June 8, 2002  
*The adsorption behavior of HsO<sub>4</sub> on quartz surfaces is predicted on the basis of its chemical stability.* –MZ
- (AN#109) - Mt - Meitnerium  
N/A
- (AN#110) - Ds - Darmstadtium  
N/A

(AN#111) - Rg - Roentgenium  
 Predicted Properties of the Superheavy Elements. II. Element 111, Eka-Gold, O. L. Keller, Jr., C. W. Nestor, Jr., Thomas A. Carlson, and Burkhard Fricke  
*J. Phys. Chem.* **1973**, *77* (14), pp 1806–1809  
 DOI: [10.1021/j100633a017](https://doi.org/10.1021/j100633a017)  
 Publication Date: July 1973  
*Early (1973) electronic structure study comparing Rg and Au* –TG

(AN#112) - Cn - Copernicium  
 Atomic and Molecular Properties of Elements 112, 114, and 118, Clinton S. Nash  
*J. Phys. Chem. A* **2005**, *109* (15), pp 3493–3500  
 DOI: [10.1021/jp050736o](https://doi.org/10.1021/jp050736o)  
 Publication Date (Web): March 26, 2005  
*Theoretical calculations of atoms and diatomic molecules of elements 112, 114, and 118 were conducted, and the effects of spin-orbit coupling on the expected chemistry were examined. Element 112 (copernicium) is similar in most respects to Hg, but the complex valence shell structure makes it intermediate in behavior between 6d and 7p transactinides.* –TM

(AN#113) - Nh - Nihonium  
 Atomic Properties of Element 113 and Its Adsorption on Inert Surfaces from ab Initio Dirac–Coulomb Calculations, V. Pershina, A. Borschevsky, E. Eliav, and U. Kaldor  
*J. Phys. Chem. A* **2008**, *112* (51), pp 13712–13716  
 DOI: [10.1021/jp8061306](https://doi.org/10.1021/jp8061306)  
 Publication Date (Web): December 2, 2008  
*Dirac–Coulomb calculations with comparison with Tl* –GCS

(AN#114) - Fl - Flerovium  
 Taming the Electronic Structure of Lead and Eka-lead (Flerovium) by the Relativistic Coupled Cluster Method, Rajat K. Chaudhuri, Sudip Chattopadhyay, and Uttam Sinha Mahapatra  
*J. Phys. Chem. A* **2013**, *117* (36), pp 8555–8567  
 DOI: [10.1021/jp402376b](https://doi.org/10.1021/jp402376b)  
 Publication Date (Web): May 7, 2013

*For the very heaviest elements, trends in atomic properties (here ionization potential and excitation energies) are most readily probed with first-principles calculations.* –WFS

(AN#115) - Mc - Moscovium  
 Predicted Properties of The Superheavy Elements. III. Element 115, Eka-Bismuth, O. L. Keller, Jr., C. W. Nestor, Jr., and Burkhard Fricke  
*J. Phys. Chem.* **1974**, *78* (19), pp 1945–1949  
 DOI: [10.1021/j100612a015](https://doi.org/10.1021/j100612a015)  
 Publication Date: September 1974  
*Computational study comparing Mc with Bi* - XY

(AN#116) - Lv - Livermorium  
 An Anomalous Bond Angle in (116)H<sub>2</sub>. Theoretical Evidence for Supervalent Hybridization, Clinton S. Nash and Wesley W. Crockett  
*J. Phys. Chem. A* **2006**, *110* (14), pp 4619–4621  
 DOI: [10.1021/jp060888z](https://doi.org/10.1021/jp060888z)  
 Publication Date (Web): March 18, 2006  
*Theoretical calculation shows the interesting structure of LvH<sub>2</sub> structure due to spin-orbit coupling.* –ZPL

(AN#117) - Ts - Tennessine  
 Spin–Orbit Effects on the Electronic Structure of Heavy and Superheavy Hydrogen Halides: Prediction of an Anomalous Strong Bond in H[117], Clinton S. Nash and Bruce E. Bursten  
*J. Phys. Chem. A* **1999**, *103* (5), pp 632–636  
 DOI: [10.1021/jp9843407](https://doi.org/10.1021/jp9843407)  
 Publication Date (Web): January 13, 1999  
*MRCI and CCSD(T) calculations of the bond energy and bond length of HTs show that the 8s orbital contributes significantly to bonding due to spin-orbit effects.* –GCS

(AN#118) - Og - Oganesson  
 Atomic and Molecular Properties of Elements 112, 114, and 118, Clinton S. Nash  
*J. Phys. Chem. A* **2005**, *109* (15), pp 3493–3500  
 DOI: [10.1021/jp050736o](https://doi.org/10.1021/jp050736o)  
 Publication Date (Web): March 26, 2005  
*CCSD(T) study of Og suggests that it is much more reactive than Rn, with a Og<sub>2</sub> bond energy of 0.062 eV, compared to 0.016 eV for Rn<sub>2</sub>.* –GCS

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Haizheng Zhong, Senior Editor, JPCL <sup>ORCID</sup>  
Timothy Zwier, Senior Editor, JPCL <sup>ORCID</sup>

Andrew Gewirth: 0000-0003-4400-9907  
Theodore Goodson, III: 0000-0003-2453-2290  
Gillian R. Goward: 0000-0002-7489-3329  
Hua Guo: 0000-0001-9901-053X  
Gregory V. Hartland: 0000-0002-8650-6891  
Pavel Jungwirth: 0000-0002-6892-3288  
Stephan Link: 0000-0002-4781-930X  
Gang-yu Liu: 0000-0003-3689-0685  
Zhi-Pan Liu: 0000-0002-2906-5217  
Benedetta Mennucci: 0000-0002-4394-0129  
Timothy Minton: 0000-0003-4577-7879  
Amy S. Mullin: 0000-0002-7984-8869  
Oleg Prezhdo: 0000-0002-5140-7500  
William F. Schneider: 0000-0003-0664-2138  
Benjamin Schwartz: 0000-0003-3257-9152  
Gemma Solomon: 0000-0002-2018-1529  
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#### AUTHOR INFORMATION

##### ORCID <sup>ORCID</sup>

George C. Schatz: 0000-0001-5837-4740  
Anne B. McCoy: 0000-0001-6851-6634  
Joan-Emma Shea: 0000-0002-9801-9273  
Catherine J. Murphy: 0000-0001-7066-5575  
Gregory Scholes: 0000-0003-3336-7960  
Victor Batista: 0000-0002-3262-1237  
Kankan Bhattacharyya: 0000-0002-7463-3156  
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Daniel Crawford: 0000-0002-7961-7016  
Tanja Cuk: 0000-0002-1635-2946  
Robert Dickson: 0000-0003-0042-6194  
Howard Fairbrother: 0000-0003-4405-9728  
Maria Forsyth: 0000-0002-4273-8105  
John Fourkas: 0000-0002-4522-9584  
Franz Geiger: 0000-0001-8569-4045