Efficient Catalysts for Making Oxygen For Artificial Photosynthesis Research could lead to more efficient, cleaner hydrogen production

James Muckerman and Etsku Fujiya, Chemistry Department.

Quantum dots that produce multiple electrons per photon of absorbed light, increasing the efficiency of solar energy

The items highlighted above are just some of the high-tech nano- science applications researchers learned about at a special session hosted by the National Nanotechnology Coordination Office (NNCO) during the annual meeting of the American Association for the Advancement of Science in Boston on February 15. The ses- sion, organized by John Carter of DOE’s Brookhaven Site Office and Audrey Hair of NNCO, brought reporters face-to-face with four of America’s foremost nanotechnology experts for a wide-ranging dis- cussion on nanotechnology applications in medicine and energy.

In the Bulletin, March 7, 2008, Part I of this report featured remarks by Altair Tatur, DOE Office of Science and co-chair of the Na- nation’s Effort: Engineering and Technology (NSET) Subcommittee of the National Science & Technology Council; Robert Langer, Massa- chusetts Institute of Technology; and Emilio Mendez, Director of BNL’s Center for Functional Nanomaterials (CFN).

“DOE labs have also devised new ways to assemble and study nanomaterials,” Mendez said. Scientists at Brookhaven are work- ing on two main techniques: building nanomaterials from tem- plates and getting them to self-assemble. One of the most exciting recent developments in self-assembly is a technique using comple- mentary strands of DNA, to bind nanoparticles together to form stable, ordered structures. Such ordered colloidal structures would be essential for producing functional materials that take advantage of unique nanoscale properties such as enhanced magnetism, im- proved catalytic activity, or new optical properties.

Brookhaven’s complementary facilities, particularly the Na- tional Synchrotron Light Source (NSLS) and the proposed NSLS- II, as well as facilities at other DOE nanoscale centers, will help scientist- s better understand these nanoscale materials and properties and ensure their uniformity, consistency, and reproducibility.

Consistency will be essential for materials to be used in a com- mercial setting, as demonstrated by the session’s final speaker, Rick Hess, President and Chief Executive Officer of Konarka Tech- nologies Inc., based in Lowell, Massachusetts. Hess described his company’s development of organic solar cells, manufactured by printing “inks” made of light-absorbing polymers and nanoscale black ink- ing of plastic using techniques originally developed to produce Polaroid film. The polymers generate the current and the buckyballs carry it to electrodes for use. These cells are the most efficient solar cells currently available and are extremely lightweight, and can be manufactured on a wide range of applications where traditional solar panels wouldn’t be the right choice, Hess said.

For Artificial Photosynthesis

Water oxidation, a step in photosynthesis that involves the “water-splitting” — splitting wa- ter into hydrogen and oxygen, a very difficult chemical process that requires a large amount of energy from sunlight and metal cata- lysts to drive the process. Such catalysts are essential for producing molecules that can be used to make hydrocarbons.

“For the water oxidation reaction, it is generally believed to be the ‘limiting’ process, mean- ing that if it is not catalyzed efficiently, the total hydrogen production,” said James Muck- erman of BNL’s Chemistry Department, co-author on the paper. “You can’t sustain hydrogen production without the presence of catalysts. So, to make hydrogens from water for use in fuel cells, we must meet the challenge of performing efficient and inexpensive water oxidation.”

Co-author Etsku Fujita, also of Chemistry, explains how the research team has been collaborat- ing with Japanese scientists Koji Tanaka and Tohru Wada, who in 2001 discovered a novel catalyst that appears quite promising for water oxidation.

“We are combining theoristi- cal and experimental studies to determine how this ruthenium complex with bound quinone molecules efficiently catalyzes water oxidation to form oxy- gen,” she said.

To accomplish the water- oxidation reaction, Tanaka and Wada immobilized the ruthenium catalyst on an electrode, placed it in an aqueous solution, and applied a voltage, resulting in a rapid turnover for oxidizing water to oxygen. The research team, which also includes BNL’s Dmitry Polyansky, continues to collaborate on further studies to understand the details of how the catalyst works.

The scientists have discovered that when the protons from two water molecules are removed due to acid-base reactions in solution, four electrons are trans- ferred to electron receptor sites in the catalyst. Once all the pro- tons are removed, the theoretical calculations predict that an oxy- gen-oxygen bond is formed.

What makes this catalyst novel is that in most metal- based compound catalysts these electron receptor sites are lo- cated on the metal atoms, but in this ruthenium complex the re- ceptor sites are on the quinone molecules. More theoretical and experimental studies will be needed to understand the mechanisms of quinone-containing catalysts.

The Benefits

Producing hydrogen from water would offer several ben- efits over current methods of production, including steam reform- ing of natural gas, which produces carbon dioxide along with the hydrogen. Heat de- rived from fossil-fuel combus- tion is currently used to drive the steam reforming process, resulting in increased greenhouse gas emissions.

Inorganic Chemistry

“Water oxidation, a step in photosynthesis with the goal of turning light into energy, is one part of the complex natural process of photosynthesis, is one part of the complex natural process of photosynthesis, is the opposite of what occurs in plant leaves—and that’s the challenge we have here,” said James Muckerman of BNL’s Chemistry Department, co-author on the paper. “You can’t sustain hydrogen production without the presence of catalysts. So, to make hydrogens from water for use in fuel cells, we must meet the challenge of performing efficient and inexpensive water oxidation.”

343th Brookhaven Lecture, 3/19

O’Brien on ‘What We Have Learned So Far at RHIC’

The Relativistic Heavy Ion Collider (RHIC) is just completing its eighth year of physics operation at BNL. RHIC is one of the world’s premier nuclear physics research facili- ties, and during the past eight years, its physics program has emphasized the creation, observation, and explanation of nuclear matter created at temperatures and densities that last existed in the universe 13.7 billion years ago.

The RHIC accelerator and as- sociated detectors were built to study the strong nuclear force that holds the quarks and glu- ons that make up the nucleus of an atom together. At the start of the project, scientists hoped to observe the formation of a new state of matter, a gas-like plasma of quarks and gluons, known as quark-gluon plas- ma, however, was quite different.

To learn about “What We Have Learned So Far at RHIC” — What we set out to do, What we discovered, and Why it is important,” join Edward O’Brien, a senior physicist in the Physics Department as he talks on this topic for the 343th Brookhaven Lecture, to be held at 4 p.m. in

Berker Hall on Wednesday, March 19. All are welcome to this free lecture, open to the public. Visitors to the Lab of 16 and over must carry a photo ID.

O’Brien has been a member of the PHENIX experiment at RHIC since it was established in 1992, and the PHENIX Director of Operations for the past seven years. In his lecture, he will dis- cuss what RHIC scientists found — instead of what they expected to find — and how that finding both challenges the existing theory and gives the opportu- nity to gain new understanding about the strong force.

With a Ph.D. in physics from the University of Illinois, O’Brien joined BNL in May 1987. Before joining the PHE- NIX collaboration, he did re- search on both a neutrino oscil- lation experiment and a heavy ion fixed-target experiment at BNL’s Alternating Gradient Synchrotron accelerator.

Additional events will be offered before and after the lecture. To join the lecture at a restaurant off site for supper after the talk, contact Marielle Faulkner, Ext. 4064, faulknerl@bnl.gov, or Rachel Nieves, Ext. 3500, stachel @bnl.gov.

— Liz Seubert
CIGNA Representative

A CIGNA Healthcare representative is available as needed in Human Resources, Bldg. 400, Room 109, Ext. 9900, or by phone to assist with claims issues you have been unable to resolve through CIGNA’s Customer Service Number (1-800-CIGNA24). Mary Beth Kivlen will be available by appointment only. You will need to provide all pertinent documentation. Call the Benefits Office, Ext. 5126.
4th Annual Dr. Mo Shiah Lin Scholarship

Call for applications

BERA’s Asian Pacific American Association (APAA) is accepting applications for the 4th annual Dr. Mo Shiah Lin Scholarship, honoring the late Lin, a distinguished scientist in BNL’s Energy Sciences & Technology Department.

In honor of Lin’s research, remarkable achievements, and inventions, a one-time award of $1,000 is granted each year to an Asian American with a student visa who is matriculating toward a doctorate at an accredited institution of higher education on Long Island (including Queens and Brooklyn) in environmental & energy technology, biology, or chemistry.

The criteria for selection include academic records, references, career goals, and other factors deemed appropriate by the committee.

The selection is chosen by a selection committee consisting of scientists at BNL and members of the APAA. The scholarship will be granted independent of financial need and without regard to other aid to the student.

With this scholarship, the Lin family hopes to make a difference for students who come to the United States, like Dr. Lin, to pursue higher education and achieve their research goals with the purpose of making significant contributions to the environment and improving the lives of all humankind.

In Memoriam

Albert Beauchere, who joined the Department of Applied Science on September 8, 1975, as a development engineer I, and retired on April 8, 1983, as a research engineer I, died at the age of 80 on March 6, 2008.

Edward Sayre, who joined the Chemistry Department as an associate chemist on January 4, 1952, received tenure as a chemist in 1959, and was named a senior chemist in 1965, died on August 7, 2005. He was 82.

Nicholas Parrinello, who joined the Mechanical Engineering Development Department on July 1, 1966, as a water treatment engineer II, died at age 86 on October 1, 2007. He continued with research for four years as a senior physicist with tenure from the National Synchrotron Light Source (NRLS) Department on July 1, 1964, as a senior designer, and retired as a guest scientist in 1981.

Leroy Blumberg, who joined the Accelerator Development Department on July 1, 1966, as an associate physicist, and retired as a senior physicist with tenure from the National Synchrotron Light Source (NRLS) Department on September 30, 1994, died at the age of 78 on October 12, 2007. He continued with research for four years as a guest scientist until 1998.

Rodney Richter, who became a technician II in the Department of Applied Science on January 1, 1956, and retired as a technical associate II in the Department of Applied Science on April 30, 1986, died on October 19, 2007. He was 78.

Patsy Andrisani, who joined the Accelerator Development Department on February 11, 1994, died at 76 on August 4, 2007. She joined the Department of Applied Science on April 30, 1986, as a secretary II in the Department of Applied Science, and retired as a secretary III in the Director’s Office, Patsy Andrisani, died on October 19, 2007. He was 78.

Roger Stoutenburgh, D0180602, a custodian on May 23, 1994, and retired as a Laboratory custodian on November 19, 2007, at 83. He retired as PGA senior technical assistant II in the Department of Applied Science on April 30, 1986, as a laboratory assistant B on his own arrangements of folk tunes from around the world. Sponsored by BERA, the company that manages BNL, this free concert is open to the public. Visitors to the Lab of 16 and over must carry a photo ID.

Parent Volunteers Needed

Parent volunteers are needed to help prepare for “Take Our Children to Work Day,” which will be held on Thursday, April 24. Contact Erin Tucker, Ext. 5735, tuckert@bnl.gov, or Liz Gilbert, Ext. 2315, gibbert@bnl.gov for more information.

Reimbursement Account Deadline

According to the Internal Revenue Service, contributions to health care or dependent day care accounts not used by the end of the calendar year will be forfeited. So, do not forget to use balances within all 2007 reimbursement accounts by claiming expenses incurred in 2007. To do so, submit claim forms by March 31, 2008.

Camera Club Meeting, 3/20

The next meeting of the Camera Club will be held noon-1 p.m. on Thursday, March 20, in Berkner Hall, Room C. Henry Kahnhauser will demonstrate the popular program Adobe Elements. Beginners and nonmembers are always welcome. For more information, call club president Ripp Bowman, Ext. 4672.

BERA Events

Tax Assistance Workshop for Visiting Foreign Nationals

Roger Stoutenburgh, D0180602, a custodian on May 23, 1994, and retired as a Laboratory custodian on November 19, 2007, at 83. He retired as PGA senior technical assistant II in the Department of Applied Science on April 30, 1986, as a laboratory assistant B on his own arrangements of folk tunes from around the world. Sponsored by BERA, the company that manages BNL, this free concert is open to the public. Visitors to the Lab of 16 and over must carry a photo ID.

Parent Volunteers Needed

Parent volunteers are needed to help prepare for “Take Our Children to Work Day,” which will be held on Thursday, April 24. Contact Erin Tucker, Ext. 5735, tuckert@bnl.gov, or Liz Gilbert, Ext. 2315, gibbert@bnl.gov for more information.

Reimbursement Account Deadline

According to the Internal Revenue Service, contributions to health care or dependent day care accounts not used by the end of the calendar year will be forfeited. So, do not forget to use balances within all 2007 reimbursement accounts by claiming expenses incurred in 2007. To do so, submit claim forms by March 31, 2008.

Camera Club Meeting, 3/20

The next meeting of the Camera Club will be held noon-1 p.m. on Thursday, March 20, in Berkner Hall, Room C. Henry Kahnhauser will demonstrate the popular program Adobe Elements. Beginners and nonmembers are always welcome. For more information, call club president Ripp Bowman, Ext. 4672.

BERA Events

Tax Assistance Workshop for Visiting Foreign Nationals

Roger Stoutenburgh, D0180602, a custodian on May 23, 1994, and retired as a Laboratory custodian on November 19, 2007, at 83. He retired as PGA senior technical assistant II in the Department of Applied Science on April 30, 1986, as a laboratory assistant B on his own arrangements of folk tunes from around the world. Sponsored by BERA, the company that manages BNL, this free concert is open to the public. Visitors to the Lab of 16 and over must carry a photo ID.

Parent Volunteers Needed

Parent volunteers are needed to help prepare for “Take Our Children to Work Day,” which will be held on Thursday, April 24. Contact Erin Tucker, Ext. 5735, tuckert@bnl.gov, or Liz Gilbert, Ext. 2315, gibbert@bnl.gov for more information.

Reimbursement Account Deadline

According to the Internal Revenue Service, contributions to health care or dependent day care accounts not used by the end of the calendar year will be forfeited. So, do not forget to use balances within all 2007 reimbursement accounts by claiming expenses incurred in 2007. To do so, submit claim forms by March 31, 2008.

Camera Club Meeting, 3/20

The next meeting of the Camera Club will be held noon-1 p.m. on Thursday, March 20, in Berkner Hall, Room C. Henry Kahnhauser will demonstrate the popular program Adobe Elements. Beginners and nonmembers are always welcome. For more information, call club president Ripp Bowman, Ext. 4672.

BERA Events

Tax Assistance Workshop for Visiting Foreign Nationals

Roger Stoutenburgh, D0180602, a custodian on May 23, 1994, and retired as a Laboratory custodian on November 19, 2007, at 83. He retired as PGA senior technical assistant II in the Department of Applied Science on April 30, 1986, as a laboratory assistant B on his own arrangements of folk tunes from around the world. Sponsored by BERA, the company that manages BNL, this free concert is open to the public. Visitors to the Lab of 16 and over must carry a photo ID.

Parent Volunteers Needed

Parent volunteers are needed to help prepare for “Take Our Children to Work Day,” which will be held on Thursday, April 24. Contact Erin Tucker, Ext. 5735, tuckert@bnl.gov, or Liz Gilbert, Ext. 2315, gibbert@bnl.gov for more information.

Reimbursement Account Deadline

According to the Internal Revenue Service, contributions to health care or dependent day care accounts not used by the end of the calendar year will be forfeited. So, do not forget to use balances within all 2007 reimbursement accounts by claiming expenses incurred in 2007. To do so, submit claim forms by March 31, 2008.

Camera Club Meeting, 3/20

The next meeting of the Camera Club will be held noon-1 p.m. on Thursday, March 20, in Berkner Hall, Room C. Henry Kahnhauser will demonstrate the popular program Adobe Elements. Beginners and nonmembers are always welcome. For more information, call club president Ripp Bowman, Ext. 4672.

BERA Events

Tax Assistance Workshop for Visiting Foreign Nationals

Roger Stoutenburgh, D0180602, a custodian on May 23, 1994, and retired as a Laboratory custodian on November 19, 2007, at 83. He retired as PGA senior technical assistant II in the Department of Applied Science on April 30, 1986, as a laboratory assistant B on his own arrangements of folk tunes from around the world. Sponsored by BERA, the company that manages BNL, this free concert is open to the public. Visitors to the Lab of 16 and over must carry a photo ID.

Parent Volunteers Needed

Parent volunteers are needed to help prepare for “Take Our Children to Work Day,” which will be held on Thursday, April 24. Contact Erin Tucker, Ext. 5735, tuckert@bnl.gov, or Liz Gilbert, Ext. 2315, gibbert@bnl.gov for more information.

Reimbursement Account Deadline

According to the Internal Revenue Service, contributions to health care or dependent day care accounts not used by the end of the calendar year will be forfeited. So, do not forget to use balances within all 2007 reimbursement accounts by claiming expenses incurred in 2007. To do so, submit claim forms by March 31, 2008.

Camera Club Meeting, 3/20

The next meeting of the Camera Club will be held noon-1 p.m. on Thursday, March 20, in Berkner Hall, Room C. Henry Kahnhauser will demonstrate the popular program Adobe Elements. Beginners and nonmembers are always welcome. For more information, call club president Ripp Bowman, Ext. 4672.

BERA Events

Tax Assistance Workshop for Visiting Foreign Nationals

Roger Stoutenburgh, D0180602, a custodian on May 23, 1994, and retired as a Laboratory custodian on November 19, 2007, at 83. He retired as PGA senior technical assistant II in the Department of Applied Science on April 30, 1986, as a laboratory assistant B on his own arrangements of folk tunes from around the world. Sponsored by BERA, the company that manages BNL, this free concert is open to the public. Visitors to the Lab of 16 and over must carry a photo ID.
Position Notices

Managers, employees, and authorized coordinators should select the best-qualified candidate for an available position. Authority to hire is vested under:
1. present benefits-eligible employees who are members of a bargaining unit.
2. present, non-bargaining unit employees who, with the Affirmative Action Plan, selection are mandated to represent a nationally recognized minority, sex, or veteran status.
Each classified position will receive the above new position notices, first, so employees are aware of new positions that will be open for application. The job for which you apply must necessarily represent an opportunity for you to apply for on the basis of your experience. Otherwise, positions will be open for one year after publication of the position notices unless otherwise specified. Current job openings on the World Wide Web are found at www.bnl.gov/hrweb/.

LABORATORY RECRUITMENT - Opportunities

MANAGER, RESEARCH OPERATIONS OF FIR. Job ID #110470.
Requires an advanced degree or professional certification in chemical engineering, mathematics, computer science, or a related field and 3 years of management experience with a major energy project involving 15 plus years of relevant experience with international organizations.

NONPROLIFERATION & NATIONAL SECURITY. Requires a Ph.D. degree and extensive experience in the management of computer science research and development projects. The candidate will be responsible for the management of the Lawrence Berkeley National Laboratory computer science program for the Department of Energy.

Communications, Information, and Computing Div.

NEW YORK STATE UNIVERSITIES. Requires a Ph.D. in biochemistry or a closely related field. This individual will work with the Department Chairs for ES&H performance management, quality assurance, and self-assessment.

Laboratory Director for Energy, Environment and Sustainability. Requires an advanced degree or professional certification in chemical engineering, mathematics, computer science, or a related field and 3 years of management experience with a major energy project involving 17 plus years of relevant experience with international organizations.

Motor Vehicles & Supplies

CART - snowboard, ap. R. R. #18038, p. 31. $15.
CHEVY DODGE DUMP TRUCK - Diesel, 27R, mt. 17.1, $7,000.00. 4/26/99.
CHEROKEE 2750 - 5th wheel trailer, mid-profile, bunk, sleeps 6, $1,425. Ext. 710, 6/23/92.


ASSISTANT PHYSICIST - X-RAY OPTICS (5-7). Requires a Ph.D in Physics or a related field and experience in the measurement and development of x-ray systems for industrial, medical, and research applications.

ACCELERATOR PHYSICIST (5-7, 5-5). Requires a Ph.D. in Physics or a related field and extensive experience in the development and operation of e+ e- linear colliders, and fluoro-lithium cryogenics.

PROJECT ENGINEER I - CRYOGENIC PRL. Requires a BS degree in engineering and at least ten plus years of cryogenic system design experience. An advanced degree is highly desirable. Knowledge of cryogenic systems design and experience in the design and development of basic systems and test procedures is required. A working knowledge of cryogenic systems testing and fabrication is required. Working knowledge of cryogenic systems and fluidics, as well as an understanding of cryogenic safety is essential.

Furnishings & Appliances

22315 - 2055, 1004, 8th St. Bethpage, NY 11714. $450/mo. 5/15/99.

FLATBOARD TV - Panasonic, 42”, $360/33” tv. 3/2/99.


MAKING LOVE RECORD - G.E. 2 stage, $50.

TVO CONVERTER BOX - COMBO - $160.00.

Audio, Video & Computers

DRUM MACHINE - Yamaha, R-5, power supply, $100. Ext. 3120.

WANTED - All brands, all new, or near. $5 or #833 Papi Dest, Ext. 3793.

STAGE - Used, 72 inch, $950.00, Ext. 508.

Free

No Smokers - No Pets - No Kids - No Volunteers


Hospitals & Equipment - Equipment


Hospitals & Equipment - Equipment


Departmental Opportunities

May request consideration for themselves, and, with the Affirmative Action Plan, selections are made without regard to age, race, color, religion, national origin, sex, or veteran status.

Shake a hand, make a friend, or find out how to get to the man.

Retirement - Announcements of Retirement. Employee will be notified at least 60 days prior to the effective date of retirement services.

Managers, employees, and authorized coordinators should select the best-qualified candidate for an available position. Authority to hire is vested under:


MANAGER, RESEARCH OPERATIONS OF FIR. Job ID #110470.
Requires an advanced degree or professional certification in chemical engineering, mathematics, computer science, or a related field and 3 years of management experience with a major energy project involving 17 plus years of relevant experience with international organizations.

Nonproliferation & National Security. Requires a Ph.D. degree and extensive experience in the management of computer science research and development projects. The candidate will be responsible for the management of the Lawrence Berkeley National Laboratory computer science program for the Department of Energy.

Communications, Information, and Computing Div.

NEW YORK STATE UNIVERSITIES. Requires a Ph.D in biochemistry or a closely related field. This individual will work with the Department Chairs for ES&H performance management, quality assurance, and self-assessment.

Laboratory Director for Energy, Environment and Sustainability. Requires an advanced degree or professional certification in chemical engineering, mathematics, computer science, or a related field and 3 years of management experience with a major energy project involving 17 plus years of relevant experience with international organizations.

Motor Vehicles & Supplies

CART - snowboard, ap. R. R. #18038, p. 31. $15.
CHEVY DODGE DUMP TRUCK - Diesel, 27R, mt. 17.1, $7,000.00. 4/26/99.
CHEROKEE 2750 - 5th wheel trailer, mid-profile, bunk, sleeps 6, $1,425. Ext. 710, 6/23/92.


ASSISTANT PHYSICIST - X-RAY OPTICS (5-7). Requires a Ph.D in Physics or a related field and experience in the measurement and development of x-ray systems for industrial, medical, and research applications.

ACCELERATOR PHYSICIST (5-7, 5-5). Requires a Ph.D. in Physics or a related field and extensive experience in the development and operation of e+ e- linear colliders, and fluoro-lithium cryogenics.

PROJECT ENGINEER I - CRYOGENIC PRL. Requires a BS degree in engineering and at least ten plus years of cryogenic system design experience. An advanced degree is highly desirable. Knowledge of cryogenic systems design and experience in the design and development of basic systems and test procedures is required. A working knowledge of cryogenic systems testing and fabrication is required. Working knowledge of cryogenic systems and fluidics, as well as an understanding of cryogenic safety is essential.

Furnishings & Appliances

22315 - 2055, 1004, 8th St. Bethpage, NY 11714. $450/mo. 5/15/99.

FLATBOARD TV - Panasonic, 42”, $360/33” tv. 3/2/99.


MAKING LOVE RECORD - G.E. 2 stage, $50.

TVO CONVERTER BOX - COMBO - $160.00.

Audio, Video & Computers

DRUM MACHINE - Yamaha, R-5, power supply, $100. Ext. 3120.

WANTED - All brands, all new, or near. $5 or #833 Papi Dest, Ext. 3793.

STAGE - Used, 72 inch, $950.00, Ext. 508.

Free

No Smokers - No Pets - No Kids - No Volunteers


Hospitals & Equipment - Equipment