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TOYOHASHI UNIVERSITY of TECHNOLOGY e-Newsletter

News and views from one of Japan's most innovative and dynamic science and technology-based academic institutes

豊橋技術科学大学

No. 2, March 2011

Feature

The Toyohashi University of Technology Tenure Track Program

The Electronics-Inspired Interdisciplinary Research Institute (EIIRIS) at Toyohashi University of Technology (Toyohashi Tech) is the research base for the ten young researchers participating in the Tenure Track Program.

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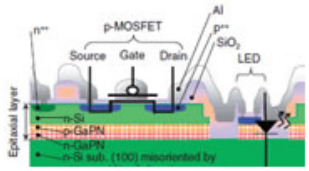

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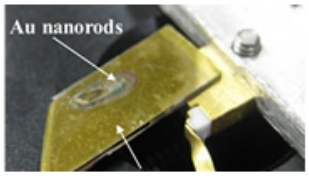

Tech-Overtures

High efficiency infrared photodetectors using gold nanorods

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Features

Interdisciplinary research at Toyohashi Tech: The Tenure Track Program

Some of the members of the Tenure Track program.
From left to right (standing): Alexander Baryshev, Ryugo Tero, Tetsuto Minami, Naoko Yoshida, Sang Yoon Park, and Dzmitry Tsetserukou Left to right-sitting: Nobuo Misawa, Hiroshi Okada (Associate Professor of EIIRIS), and Rika Numano

The Electronics-Inspired Interdisciplinary Research Institute (EIIRIS) at Toyohashi University of Technology (Toyohashi Tech) is the research base for the ten young researchers participating in the Toyohashi Tech Tenure Track Program.

The Toyohashi Tech Tenure Track Program is funding an international group of 10 researchers from a wide range of research backgrounds to collaborate on interdisciplinary research topics for advanced applications that will benefit society. The program lasts five years, during which time the researchers will be evaluated for promotion to tenured positions at Toyohashi Tech.

Here we talk with four of the Tenure Track researchers to learn about their first impressions of the program, which is just getting under way.

Alexander Baryshev has a doctorate from St Petersburg in Russia and specializes in solid-state physics, with a focus on nano-photonics. He came to Japan seven years ago as a post-doctoral researcher at Toyohashi Tech and is now an associate professor of the Tenure Track program. “First I want to get to know all my fellow researchers and learn more about their research backgrounds,” says Baryshev. “Then I must find out what connections I can make with them.”

Sang Yoon Park is from Seoul, and came to Japan in 2008 to continue research on magnetism after obtaining his doctorate from Hanyang University, South Korea. “After research work at Tokyo Institute of Technology, I was thinking of going on to the US until I heard about EIIRIS,” says Park. “My application for the tenure track program was successful and now I am pursuing my research plans at EIIRIS during the five year program.”

Nobuo Misawa, a native of Aomori, Japan, has a doctorate from the Graduate University for Advanced Studies, Kanagawa, Japan, and specializes in bio-materials and chemical sensors using living cells, and their integration silicon devices. “The facilities at EIIRIS are excellent. I’m looking forward to continuing my research to make compact bio-chip sensors.”

Ryugo Tero hails from Sendai, Japan, and has a doctorate from the University of Tokyo, after which he was a researcher on bio-mimicking systems at the Institute for Molecular Science in Okazaki before joining EIIRIS in October 2010. “My boss at Okazaki gave me a lot of freedom to conduct my own research,” says Tero. “Now at EIIRIS, I want to continue my studies in my own lab and build on what I’ve learnt.”

The researchers are satisfied with the living conditions and the pleasant environment of the campus—about 8 km from Toyohashi Station—with green surroundings, break taking views of nearby mountains, and only about 4 km from the Pacific Ocean.

“What is important to note is that the new Institute is designed to foster face-to-face collaboration on a daily bases,” says EIIRIS Chief Scientist Adarsh Sandhu, who has 25 years of research experience in Japan and a background in nano-bio-magnetics. Besides collaboration between individuals, he notes that the researchers hold regular meetings to review progress and stay in tune with each other’s research.

The researchers agree that the ultimate goal, “is to make one plus one equal three”, and thereby create an innovative model for interdisciplinary research.

Electronics-Inspired Interdisciplinary Research Institute (EIIRIS):

- http://www.eiiris.tut.ac.jp/index.html

Tenure Track Program:

- http://www.tut.ac.jp/wakate/staff/index.html (Japanese)
- http://www.eiiris.tut.ac.jp/department_members/index.html (English)

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News

International Symposium on Quality Assurance and International Standards of Engineering Education

Educators can learn a lot from each other by regular discussion to keep up the needs of an increasingly interlinked global society. With this background, Toyohashi University of Technology (Toyohashi Tech) invited four prominent academics from Europe to take part in a symposium on 'Quality Assurance and International Standards of Engineering Education－Case Study on Practice in Europe' on 18 January 2011.

Approximately 100 people attended the symposium, held at the Toyohashi Associa Hotel. The symposium was opened with a speech by Toyohashi Tech President Yoshiyuki Sakaki welcoming the EU delegates and members of the audience. The EU delegates were Perttu Vartiainen, Rector of the University of Eastern Finland; Reiner Salzer, Emeritus Professor of Dresden University of Technology; Franz Börsch, Program Manager of the Foundation for the Accreditation of Study Programme in Germany; and Andoré Touboul, of the Délégué Régional à la Recherche et à la Technologie pour l'Aquitaine, France.

Following plenary talks by the EU delegates, the symposium moved onto to a panel discussion on topics that included the Bologna Process, means of improving the quality of university education, and globalization of universities.

Toyohashi Tech President Yoshiyuki Sakaki welcomes the delegates and audience to the symposium

Members of the EU delegation

Group photograph of the EU delegates and Toyohashi Tech organizers of the symposium

Toyohashi Tech welcomes robotics team from Russia

The Toyohashi University of Technology (Toyohashi Tech) Robotics Club is internationally renowned for its innovative approach to robotics as underscored by the long standing success at internationally robotics competitions.

In November 2010, members of the Toyohashi Tech Robotics Club hosted a group of students from Russia with a keen interest in robotics. The visit was part of an international program launched by the Japanese Government to encourage interaction between students in Japan and Russia, and followed a recent visit by Japanese students to Moscow.

The Russian team included 7 students, 5 faculty members, and 3 staff from the robotics competition administration office. In addition to 13 members of Toyohashi Tech robotics club, the Japanese side included three members from the University of Tokyo and one from the Tokyo University of Agriculture and Technology.

The Russian team had a busy time during their three day visit to Toyohashi. After arrival on the 16th November they visited a Toyota Motor Corporation factory followed by a welcome reception on the same evening. The 17th and 18th were taken up with the robotics competition, and on the 19th the team visited Nagoya castle. Following calls for a visit to see the Pacific Ocean, Toyohashi Tech staff took the Russian team to a local beach looking onto the Pacific Ocean—quite a hard schedule for all concerned.

Related Information
Toyohashi Tech robotics club: http://www.tut.ac.jp/english/newsletter/club_activities/index.html

Reception for the Russian team on arrival in Toyohashi

Excursion to a beach near the campus of Toyohashi Tech overlooking the Pacific Ocean

Guiding robots along race tracks during the robotics completion

A robot moving along a curved path

Scenes after completion of the competition with Shinichi Suzuki (left) of Toyohashi Tech shaking hands with Aleksei Kornilov

Toyohashi Tech holds *World Sports Festival* in October 2010

The *World Sports Festival* is one of a series of *International Interaction Day* events organized by Toyohashi University of Technology (Toyohashi Tech) to enhance mutual understanding between domestic and international students. The October sports festival follows on from a highly successful *World Tea Party*, held in July 2010.

The first *World Sports Festival* was held at the Toyohashi Tech sports ground on 23rd October 2010, and organized by the *CIR* (Centre for International Relations) and *CALL Club* (International Exchange Club).

The weather was ideal for the sports event—sunny with a slight breeze. A total of 80 students—both overseas and domestic—and university staff members joined the festivities.

The programme included 12 sporting events:

- Japanese gymnastics
- Tamaire (Japan)
- Spoon relay (India)
- Three- people, four-legged relay (China>)
- Guru Guru bat (Malaysia)
- Mark Kaen (Laos)
- Nhay Sap (Vietnam)
- Ten Cans (Myanmar)
- Kabbadi (Bangladesh / India)
- Galah Adang (Malaysia)
- Benteng (Indonesia)
- Dodge Ball (Japan)

Future plans include the ‘International Recycle Festa’ in March 2011, where participants will be able to exchange items, such as books and household goods that they do not use any more.

There are many overseas students and researchers studying at Toyohashi Tech. In fact, with ~10 % of the undergraduate and graduate students coming from overseas, Toyohashi Tech has one of the largest percentage of international students studying of any national Japan.

Related information

- Center for International Relations: http://www.cir.tut.ac.jp/english/index.html

Toyohashi University of Technology International Exchange Club, *TUT CALL*: http://call2010tut.web.fc2.com/index.html

GalahAdang

MarkKaen

NhaySap

Spoon race

Tamaire

Visitors

17th January 2011
Yoshimitsu Kobayashi, President of Mitsubishi Chemical Holdings gives a lecture entitled: ‘The Kaiteki Company’

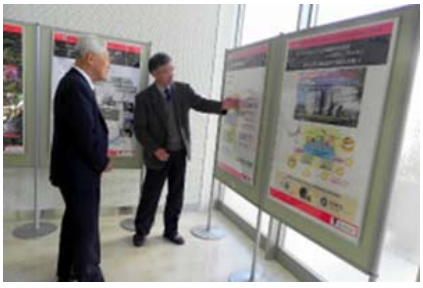

President Yoshiyuki Sakaki welcomes Yoshimitsu Kobayashi prior to his lecture


Yoshimitsu Kobayayashi delivers his lecture to students and faculty

January 26th 2011
Dr Hiroyuki Watanave, Senior Technical Executive, Toyota Motor Corporation, gives a talk about the future of the automobile industry

Hiroyuki Watanabe discusses the future of the automobile industry

17th January 2011
Tsuneo Ishimaru, Executive Advisor to Denso Corporation visit EIIRIS and VBL.


Tsuneo Ishimaru (left) hear more about EIIRIS from vice president Makoto Ishida


Tsuneo Ishimaru visits the Venture Business Laboratory


Tsuneo Ishimaru takes a ride in a personal vehicle developed at Toyohashi Tech

21 December 2010
Shoichiro Toyoda, Honorary Chairman of Toyota Motor Corporation, visit Toyohashi Tech.


Shoichiro Toyoda visits EIIRIS (Electronics-Inspired Interdisciplinary Research Institute)


Shoichiro Toyoda visits the Center for Human-robot Symbiosis Research Center

Research highlights

Health and environment: New microorganisms for cleaning up PCB contamination

Innovative microactuators: Compact 3.5 mm cubic rotary-linear piezoelectric actuator

Optoelectronic integrated circuits: Silicon and nitride LEDs integrated onto a single chip for one-bit digital counters

Coating technology: Interaction of free falling copper droplets with heated substrates

Neuroscience: Blue in the face

PAGETOP

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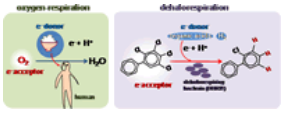
Research highlights

Health and environment: New microorganisms for cleaning up PCB contamination

Naoko Yoshida



Enlarge Image
Reductive dehalogenation by dehalorespiring bacteria (DHRB)

Polychlorinated biphenyls (PCBs) are a family of so-called 209 biphenyl congeners are major pollutants and pose a threat to human health and the environment.

A promising remediation technology is bioremediation using dehalorespiring bacteria (DHRB), which dehalogenate PCBs to less chlorinated biphenyls via respiration, although as yet only three bacteria have been isolated and their dehalogenation activities have been limited to doubly flanked chlorines of PCBs.

Now, Naoko Yoshida and colleagues at Ecotopia science institute in Nagoya University, Japan, successfully obtained DHRB that dehalogenated a variety of aromatic halides including polychlorinated phenols, benzenes, biphenyls, and dibenzo-*p*-dioxins.

The DHRB were obtained by sequential transfer culture of paddy-soil with lactate and 4,5,6,7-tetrachlorophthalide (commercially known as 'fthalide')—an effective fungicide for rice blast disease that is phylogenetically identified as a novel species of genus *Dehalobacter*.

The dechlorination activity of the *Dehalobacter* sp. for PCBs was observed for chlorines substituted at the *para*, *meta*, and *ortho* positions of PCBs, which included not only doubly flanked chlorine and but also singly flanked chlorines.

The researchers are confident that *Dehalobacter* sp will lead to an expansion of the dechlorination spectrum of PCBs in the bioremediation process for PCBs-contaminated sites.

Reference:

- Naoko Yoshida[1], Lizhen Ye[2], Daisuke Baba[2], and Arata Katayama[2]
- A novel *Dehalobacter* species is involved in extensive 4,5,6,7-tetrachlorophthalide dechlorination
- *Applied and Environmental Microbiology* **75**, 2400–2405 (2009).
- Digital Object Identifier (DOI): 10.1128/AEM.02112-08
- [1]Naoko Yoshida is now at the Electronics-Inspired Interdisciplinary Research Institute (EIIRIS), Toyohashi University of Technology, Aichi, Japan.
- [2]EcoTopia Science Institute, Nagoya University.
- Electronics-Inspired Interdisciplinary Research Institute (EIIRIS), Toyohashi University of Technology: http://www.eiiris.tut.ac.jp/
- EcoTopia Science Institute, Nagoya University: http://www.esi.nagoya-u.ac.jp/eng/

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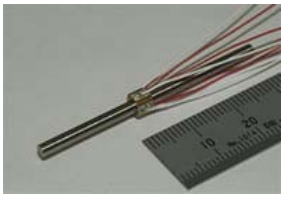
Research highlights

Innovative microactuators: Compact 3.5 mm cubic rotary-linear piezoelectric actuator

Tomoaki Mashimo



Microactuators are critical components for industrial applications such as MEMS, micro-medical devices, and microrobotics. However, the fabrication of increasingly sophisticated, millimeter sized microactuators is complicated and proving to be a challenge.

Here, in an innovative approach, Tomoaki Mashimo has fabricated a miniature rotary-linear piezoelectric actuator with a single cubic stator with a side length of only 3.5 mm, which is capable of generating both rotary motion around its central axis and linear motion in the axial direction.

The stator consisted of a single metallic cube with a side length 3.5 mm, a 2.5-mm-diameter through-hole, and four piezoelectric elements bonded to the sides of the stator. The simplicity of the design enabled the fabrication of a compact actuator, without requiring any special manufacturing procedures.

The resultant rotary and linear velocities obtained were approximately 24 rad/s and 80 mm/s, when the applied voltage was 42 Vrms at each resonant frequency. The maximum torque and thrust force were 2.5 μNm and 2.6 mN, respectively.

Mashimo expects further miniaturization and improvement in the performance of this compact actuator. "We foresee micro-robotic and medical applications using the rotary-linear piezoelectric microactuator," says Mashimo. "The microactuator simple design lends itself to many other applications as well."

- Tomoaki Mashimo[1], and Shigeki Toyama[2]
- Rotary-Linear Piezoelectric Actuator with a Cubic Stator of Side Length of 3.5 mm
- *IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control*, **57**, pp. 1825–1830, (2010).
- Digital Object Identifier (DOI): 10.1109/TUFFC.2010.1621
- [1]Tomoaki Mashimo is now at the Electronics-Inspired Interdisciplinary Research Institute (EIIRIS), Toyohashi University of Technology.
- [2]Tokyo University of agriculture and Technology, department of Mechanical system Engineering, Tokyo, Japan.
- Related website: Electronics-Inspired Interdisciplinary Research Institute (EIIRIS) http://www.eiiris.tut.ac.jp/

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Research highlights

Optoelectronic integrated circuits: Silicon and nitride LEDs integrated onto a single chip for one-bit digital counters

Silicon-based semiconductor devices dominate the microelectronics industry and are used for the fabrication of high density integrated circuits comprising of memory and processing devices. However, silicon has an indirect band gap, which severely limits its use for fabricating photonic devices such as light emitting diodes (LEDs) and lasers. A innovative solution to this problem would be the integration of silicon devices with LEDs produced using direct band gap compound semiconductors, in the form of optoelectronic integrated circuits (OEICs).

Here, Akihiro Wakahara and colleagues at Toyohashi University of Technology (Toyohashi Tech) demonstrate the first realization of a one-bit counter circuit OEIC with an optical output consisting of silicon field effect transistors integrated with gallium phosphide nitride (GaPN) LEDs on a single chip.

The monolithic integrated circuits were fabricated using lattice matched Si/GaPN/Si heterostructures grown on silicon substrates in a dual chamber molecular beam epitaxy (MBE) system. Notably, growth of the silicon capping layer at a high temperature of 850℃ led to a dramatic reduction of the threshold voltage to -2.1 V and an increase of the channel mobility of the p-MOSFET to 82 cm^2Vs. This improvement is attributed to a decrease in phosphorus incorporation during the growth of the capping layer.

The one-bit counter circuit fabricated using the n-Si/p-GaPN/n-GaPN/GaP/n-Si heterostructure exhibited normal operation, where red light emission from the input and output indicators was in synchronization with the input and output logical voltages.

Reference

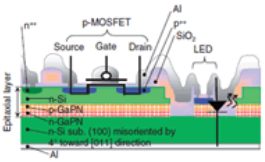
- K.Yamane[1], K. Noguchi[1], S. Tanaka[1], Y. Furukawa[1], H. Okada[2], H. Yonezu[1], and A. Wakahara[1,2]
- Operation of Monolithically-Integrated Digital Circuits with Light Emitting Diodes Fabricated in Lattice-Matched Si/III–V–N/Si Heterostructure
- *Applied Physics Express* **3,** 074201, (2010)
- Abstract and restricted links: http://apex.jsap.jp/link?APEX/3/074201/
- DOI: 10.1143/APEX.3.074201

- [1]Department of Electrical and Electronic Information Engineering, Toyohashi University of Technology, Toyohashi, Aichi 441-8580, Japan
- [2]Intelligent Sensing System Research Center, Toyohashi University of Technology, Toyohashi, Aichi 441-8580, Japan

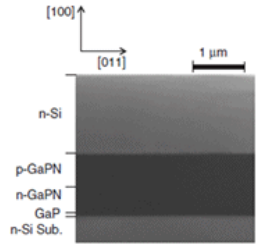
Related information

- Frontiers of Intelligent Sensing:http://www.gcoe.tut.ac.jp/english/gaiyou/index4.html

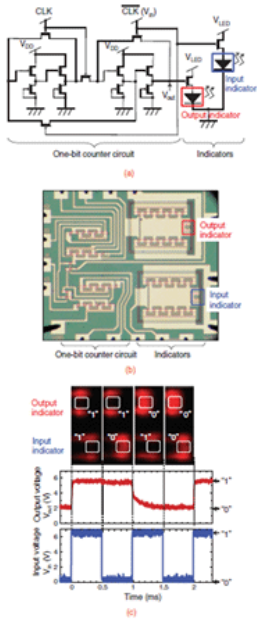
Akihiro Wakahara



One-bit counter consisting of a p-MOSFET and GaPN light emitting diode



Transmission electron microscope image showing the n-Si/p-GaPN/n-GaPN/GaP/Si heterostructure.



(a) Circuit diagram of the one-bit counter; (b) Optical image of an actual circuit; (c) Synchronization of the LED emission with input and output circuit voltages

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Research highlights

Coating technology: Interaction of free falling copper droplets with heated substrates

Controlling the physical properties of the surfaces of materials, such as metals, is critical for industrial applications ranging non-stick frying pans to the fuselage of aircraft. However, in spite of the wide spread use of the so-called thermal spraying method for coating large areas of materials, there is still insufficient knowledge about the physical mechanisms—in particular the so-called 'splat process' whereby thermally sprayed particles change from a distorted shape at the splash stage, to a disk shape—that govern the properties of sprayed particles with substrates. Such an in-depth understanding is important for improving the control and reliability of thermal spray-based coatings.

Here, Masahiro Fukumoto and co-workers at the Department of Mechanical Engineering, Toyohashi University of Technology, describe their recent findings on the splat formation process to determine why and how disk-shaped splat are formed.

Fukumoto and his group studied the effect of substrate temperature and ambient pressure on the behavior of millimeter sized, molten copper (Cu) droplets free falling onto AISI304 steel substrates.

Important findings included the observation that the porosity at the splat bottom surface dramatically decreased with increasing substrate temperature and decreasing pressure, which implies that substrate wetting by molten droplets during splat flattening may be enhanced by using higher substrate temperatures and lower spray pressures. Notably, good wetting at the splat/substrate interface resulted in disk-shaped splats, and in the opposite case, the formation of splash-splats under poor wetting conditions.

These experiments on the flattening behavior of individual splats will be useful for controlling the properties of coatings on materials by the thermal spraying process.

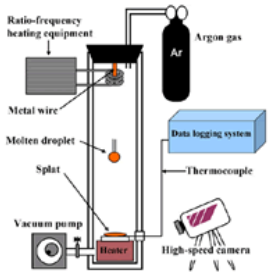
Reference

- M. Fukumoto, K. Yang, K. Tanaka, T. Usami, T. Yasui, and M. Yamada
- Effect of Substrate Temperature and Ambient Pressure on Heat Transfer at Interface Between Molten Droplet and Substrate Surface
- *Journal of Thermal Spray Technology* **20**, 48–57, (2011)
- Abstract and restricted links: http://www.springerlink.com/content/v81677q1872w52pr/
- DOI: 10.1007/s11666-010-9537-5
- Department of Mechanical Engineering, Toyohashi University of Technology, Toyohashi, Aichi 441-8580, Japan

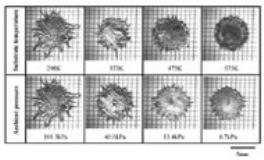
Related information

- Advanced Joining Process Laboratory, Toyohashi Tech: http://ajp.pse.tut.ac.jp/

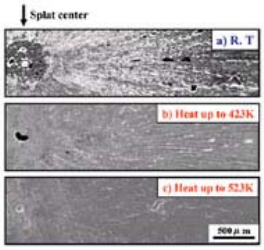
Masahiro Fukumoto



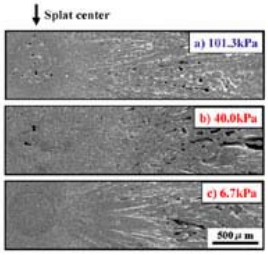
Experimental set up for monitoring free fall of Cu droplets onto steel substrates.



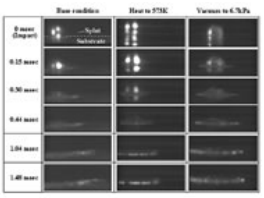
Variation of the spat shapes with substrate temperature and ambient pressure.



Variation of the bottom of splats with temperature.



Variation of the splat bottom surface with ambient pressure



Observation of the free fall of Cu droplets by high speed camera.

Variation of the top morphologies of Cu droplets on AISI304 substrates with ambient pressure.

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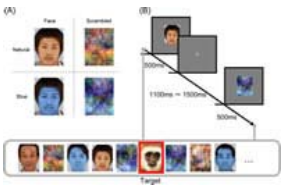
Research highlights

Neuroscience: Blue in the face

Tetsuto Minami



Enlarge Image

A blue (atypical) face color led to an increase in the amplitude of the N170 component

The way that humans perceive each other is strongly affected by the configuration, contour, and complexion of faces. Now, research on the response of the brain due to thought or perception is termed as being an 'event-related potential' or ERP, and is measured by monitoring the electrophysiological response to an internal or external stimulus by electroencephalography (EEG).

Furthermore, the so-called N170 component of ERP is due to the neural processing of faces, and is used for the analysis of the effect of facial features on human perception.

Research shows that the configuration of the face affects the amplitude and latency of the N170 component of ERP, which peaks 160–180 ms after the stimulus onset in posterior temporal electrodes. In addition to the N170 component, the role of gamma band oscillations, such as induced gamma-band activity, in visual tasks has been extensively studied.

More recent studies show that both configural information (e.g. face shape) and surface information (e.g. surface color and reflectance properties) are important for face perception. However, the influence of face color on ERP components—such as N170—is still not well understood.

Here, Tetsuto Minami and colleagues at Electronics-Inspired Interdisciplinary Research Institute (EIIRIS) at Toyohashi Tech, report on the importance of the color of faces on the N170 component as well as gamma oscillations.

The researchers compared the response of subjects to blue (atypical) and flesh (reference) colored faces. They selected blue as an atypical color because it is the complementary color of light skin. Then, they presented these faces as well as random faces in an oddball paradigm and measured the amplitude and latency of ERP and induced gamma oscillations.

The major finding of this study was that exposure to blue (atypical) face color led to an increase in the amplitude of N170, but without any effect on gamma band activity.

These results suggested that face color is important for the initial detection of a specific face.

Reference:

- T. Minami[1], K. Goto[2], M. Kitazaki[2] and S. Nakauchi[2]
- Effects of color information on face processing using event-related potentials and gamma oscillations.
- *Neuroscience* **176**, 265–273, (2011).
- Abstract and restricted links: http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T0F-51SPS4W-2&_user=10&_coverDate=12%2F24%2F2010&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=c826c308800ac4c66e51bed324ef2405&searchtype=a
- DOI: 10.1016/j.neuroscience.2010.12.026

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- Further information and websites
- Electronics-Inspired Interdisciplinary Research Institute (EIIRIS), Toyohashi University of Technology: http://www.eiiris.tut.ac.jp/

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No. 2, Mar 2011

Club Activities

Toyohashi Tech Auto Club: Not only for car lovers

As one of Japan's top engineering universities, it is no surprise that Toyohashi University of Technology (Toyohashi Tech) has a student-circle focused on cars. However, what may be surprising is that not all of the 17 members of the Automotive Club are crazy about cars.

"Some members love cars, of course," says Naoya Akazawa, the club's team leader during 2010 and now a first-year master's student in mechanical engineering. "But others are simply interested in designing things, and still others just want to build things."

All three groups find fulfillment in taking part in the annual Student Formula SAE Competition organized by the Society of Automotive Engineers of Japan. The aim of the competition is for student teams to design and build small formula racing cars so that they can put into practice the engineering skills that they have learnt in the classroom.

Some 63 universities took part in the 2009 competition, and the Toyohashi Tech Automotive Club's TG05 car was awarded a prize for technical ability in acceleration.

"It takes a whole year to design, build and test a car," says Akazawa. "Members meet officially once weekly, but you can usually find several of us getting together in the club's room almost every day."

While corporate sponsors like Honda, Topy, and MuSASHi help by donating a limited number of components, the students rely on their own initiative to come up with the rest of the parts and materials needed to take the car from the drawing board to the racing track.

"We build many of our own parts," explains Tatsuya Fujishima, the club's new team leader and a third-year undergraduate in mechanical engineering. "In fact, we were the first university club to use carbon fiber instead of steel for the body. Carbon fiber is more expensive than steel but it is lighter and gives us an advantage in races."

The members are now busy preparing for the 2011 competition that will take place in Shizuoka Prefecture, and Fujishima says they have high hopes of finishing in the top six in the racing event and doing even better in the design competition.

Members of the Toyohashi Tech Automobile Club

The Toyohashi Tech car accelerating during competition

Automobile Club garage

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Excursions

Tezutsu Hanabi—Hand Held Fireworks— in Toyohashi

Summer in Japan is renowned for being hot and humid, and for hundreds of firework festivals. Of all the grand firework displays held all over Japan, one of the most eye-catching events is the 'tezutsu hanabi or hand held firework events, where experienced masters of the trade hold tezutsu—~80 cm long 10 cm wide bamboo cylinders entwined in hemp rope—out of which hot flames gush several meters towards the summer sky. The spectacle ends with an ear-shattering bang, signaling exhaustion of the black powder responsible for the hand held volcanic eruption.

Notably, the tradition of tezutsu hanabi is believed to have started in the mid-1500s at Yoshida Shrine—located along the Toyokawa River in Toyohashi City—which hosts the event during the annual Gion Festival in July.

Tezutsu Hanabi at Yoshida Shrine, Toyohashi City

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No. 2, Mar 2011

Tech-Overtures

High efficiency infrared photodetectors using gold nanorods

Toyohashi Tech researchers develop an innovative infrared photodetector exploiting 'plasmon resonance' at the surface of the Au nanorods, which enhances the density of photoelectrons excited over the Schottky barrier. This technology shows potential as the basis for the development of high efficiency infra-red photodetectors for optical communications systems.

Devices used for the detection of light and other forms of electromagnetic energy include calorimeters, superconducting devices, and photodiodes used in optical communications systems.

Now, typical semiconductor devices include Schottky barrier photodetectors—where a PN junction is not necessary. However, for optical communications systems applications, it is necessary to improve the photo detection efficiency in the 1.3~1.5 micrometer range of wavelengths.

Here, Mitsuo Fukuda and colleagues used the localized surface plasmon (LSP) effects exhibited by gold nano-rods to improve the optical response of Schottky photodiodes. Notably, the desired resonance wavelength can be obtained by appropriate choice of the dimensions of gold nanorods. Thus combining Schottky barriers with gold nanorods holds promise as a means of producing high efficiency photodiodes.

Fig. 1 shows the structure and dimension of the gold nanorod Schottky diode photodetector, where 10 nm x 100 nm gold rods were used. Fig .2 shows the experimental set up and Fig. 3 the experimental results for light of 1500 nm, showing a significant increase in the photocurrent of the device with the gold nano rods.

Further information

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Mitsuo Fukuda

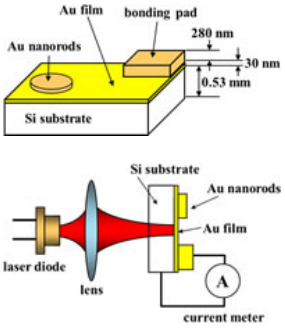

Fig.1: Device structure

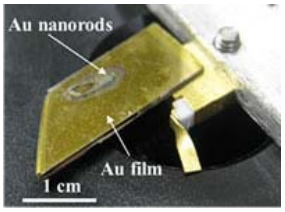

Fig. 2: Experimental set up (above) for measuring the photocurrent of the Au nanorod Schottky photodiodes (below).

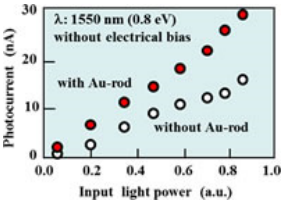

Fig. 3: Experimental results showing the significant increase in the photocurrent of the device with the gold nano rods.