

Tune

Tohoku University Research News of Engineering

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Plasma – Strawberry's Best Friend?

Toshiro
KANEKO

Ranking & Data
TOHOKU UNIVERSITY



Japan, although at first glance appearing to be highly urbanized, filled with asphalt and concrete everywhere, is actually blessed by diversity thanks to geographical setting. The country enables those here to study multiple facets, as accentuated by the relationship between people and nature. Tohoku University – sited in Sendai and the namesake region replete with innumerable assets, as highlighted by manifold offerings from culture to wildlife – is particularly suited for those driven by curiosity who seek to find out more about the world (not to mention the universe!) around us. Speaking of exploring surroundings and being cultivated, Tohoku University's Aobayama Campus is now home not only to the world-renowned Engineering Faculty but also the Agriculture Faculty. Much future synergy can be expected from the two top-notch outfits... and in fact currently there is one ongoing work that firmly connects the two.

Plasma science: wide-ranging research field

What's plasma?

Text by S. "Tex" POMEROY / Photographs by Hayato IKEGAMI

Prof. Kaneko: Plasma is the fourth state of matter that we humans have recognized, after solid, liquid and gas – furthermore two plasma types, “thermal” and “non-thermal,” are said to exist. Full-blown research into plasma itself was launched in the 1960s, but as an engineering research field it is even newer. I have been studying plasma since graduate school, on the research theme of nuclear fusion plasma. I began with high-temperature plasma, but as my coverage of plasma expanded like for nanomaterial syntheses, I found new applications of plasma, like for medicine and agriculture. I endeavored to build a wall comprised of electricity for confining plasma at onset, but my work has gone beyond confinements.

Exposing strawberry crops to an atmospheric-pressure/non-thermal plasma effluent helps counter spread of pathogens without the need for pesticide application

– What effects result from exposure of plants to plasma?

Prof. Kaneko: The spread of pathogens like fungi for powdery mildew, more sinister-sounding anthracnose (unrelated to anthrax) and such was shown to have been countered fully. And no plasma residue is left on the crops. Besides the initial equipment and installation costs, monies involved were minimal. In only a few years after 2011 the germination as well as planning stages were cleared, and the

project began running in earnest three years ago. In the past, research into application of plasma during seed-level and post-harvest stages had been documented, yet no research concerning exposure as to plants at the crop stage had been conducted. Though unable to predict the outcome, experimentation on living plants was taken on, and as with all experiments involving living things despite being under controlled conditions, didn't always yield consistent results. An engineering experiment fusing living things and science... we indeed faced much difficulties over the last three years. But we took on all the challenges and won.

Engineering And Life Sciences Add Up To Much More

Devastation of agriculture in Prof. Kaneko's home prefecture of Miyagi puts him in action

– Why did you apply plasma technology to agriculture, in particular for strawberry cultivation?

Prof. Kaneko: 2011 saw much of the Tohoku region suffering from the March 11 disaster. Having grown up and spent most of my life in the region, I was used to the plentiful foodstuff being made therein but I noticed how these were being adversely impacted. Then I spotted an agricultural area which had been devastated and decided to help a strawberry greenhouse farm near Sendai in Yamamoto-cho. Strawberry crops can be grown in enclosed settings and these enable retention of plasma inside too. The farmers responded by offering cooperation in the hope that if safe fruits and vegetables result, these would become even more viable on the market in just a few years' time, so they tried plasma applications for agriculture. I aim to realize so-called “non-pesticide-use farming via plasma” at the Japan level, readying to promote its adoption abroad in the near future under my project banner. It is said that life probably originated under lightning conditions, emerging from a plasma “soup.” I see study of this soup as providing a key to unraveling the mystery of how life originated on Earth.

Advancing into world arena under the banner of PlasmaAgri (a trademarked phrase as well)

– Can you tell us about this project?

Prof. Kaneko: We hear it is backed by Japan Science and Technology Agency (JST) supported by the Japanese government, but what is its status now? Prof. Kaneko: The banner we selected for the project was “PlasmaAgri” [registered trademark], which combines



the central ideas from the two words of plasma and agriculture... with JST support, it has been verified that our plasma mix is effective for use upon promoting plant growth, when it is applied under conditions like controlled humidity – this being one angle where our patents are based on – not to mention being able to counter the spread of pathogens without resorting to use of pesticides, as noted above. Plasma cleanses microchip substrates by grabbing impurities, so the same can be said of pathogens.

Future of plasma bright

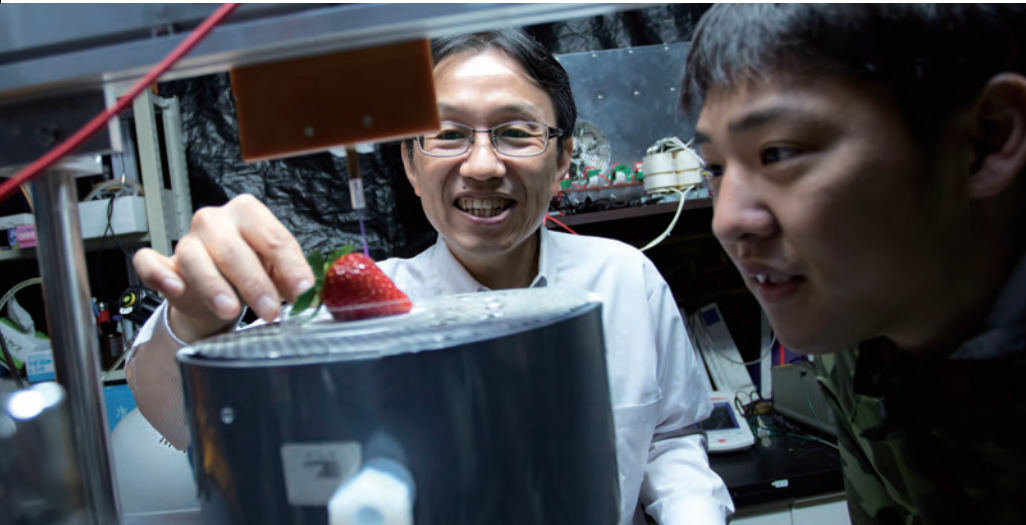
– What are your future research plans? Will it extend into food processing?

Prof. Kaneko: Yes, food processing is our next target, to be followed by distribution... and our patents have been readied accordingly. Today, plasma research has gone past semiconductor engineering, leading to development of solutions to environmental problems, followed by work involving atmospheric-pressure / non-thermal plasma; this then delves into the origination of life, in addition to applications in the fields of medicine and agriculture. Previously, plasma research could only be conducted inside vacuum devices. Now, it is possible to create plasma in atmosphere, reaching beyond the constraints of its field. Tohoku University is an academic institution with an interdisciplinary outlook, the perfect place to expand this research, in tandem with increased plasma for general applications. The future looks bright.



Dr. Toshiro KANEKO

In 1997, Toshiro Kaneko received his Ph. D from Tohoku University based on his work on Plasma Physics and Application. Then he stayed on at his beloved School of Engineering, Tohoku University until 2012 as an Assistant Professor and then an Associate Professor. From 2012, he has been a full Professor at Tohoku University, his laboratory being inside the Department of Electronic Engineering. He won the Young Scientists' Prize (The Commendation for Science and Technology by MEXT, Japan) in 2008 and Chen Ning Yang Award (Association of Asia Pacific Physical Societies) in 2013.





University Ranking

76

QS

QS World University
Rankings 2017

51

ARWU

Academic Ranking of World Universities
in Engineering/Technology and
Computer Sciences, 2016

39

Thomson Reuters
The World's Most Innovative Universities 2017

QS World University Rankings by Subject 2017

62

Engineering &
Technology

31

Mechanical &
Aero.

22

Material
Sciences

34

Chemical
Eng.

51

Civil &
Structure Eng.

51

Electrical &
Electronics



Research Activity



89

Number of papers
in Nature and Science,
2006-2015
(4th in Japanese University)



25

Number of highly cited paper
in Engineering,
2005-2015
(Top of Japanese University, Thomson Reuters)



28B JPY

Research Revenue



Statistics 2018

	Tohoku University	School of Engineering
 STUDENTS-TO-FACULTY RATIO	 1 : 6	 1 : 9
 NUMBER OF FACULTY	 3,156	 630
 NUMBER OF INTERNATIONAL STUDENTS	 2,028	 563
 UNDERGRADS	 11,052	 3,650
GRAD STUDENTS (MS)	4,174	1,541
GRAD STUDENTS (PhD)	2,625	527

Sendai, the home city of Tohoku University

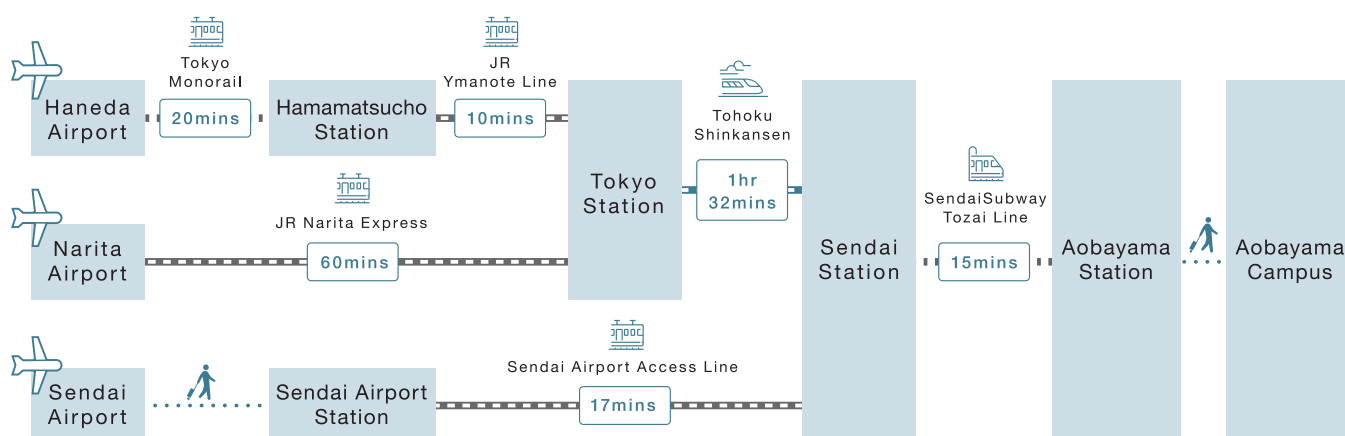
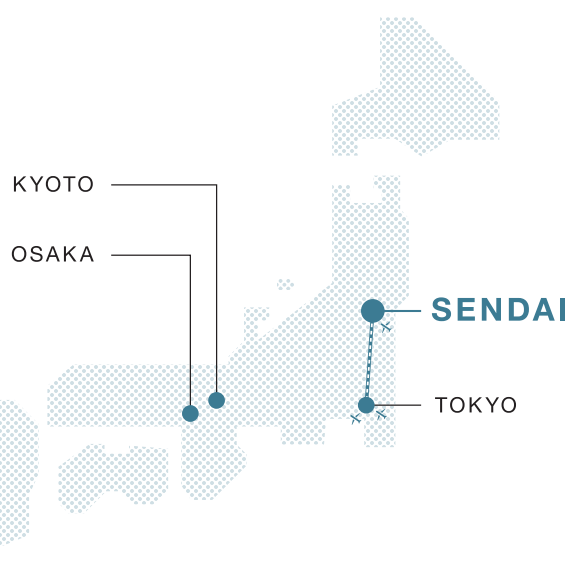


SENDAI ✈️ At a Glance

Average Temp. **12 °C**

Precipitation **1241 mm**

Sunshine **1843 hours**



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Office of Research Strategy,
School of Engineering, Tohoku University

E-mail : eng-ken@grp.tohoku.ac.jp Tel/Fax : +81-22-795-5807

Address : 6-6 Aramaki, Aoba-ku Sendai 980-8579, Japan

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