

Electrical Power Group

Yasuoka & Takeuchi Lab

Professor Koichi Yasuoka Lecturer Nozomi Takeuchi

Research Field: Plasma engineering, Electrohydrodynamics, Power engineering

Keywords: Non-equilibrium plasmas in water, Decomposition of persistent substances, Reaction control on plasma-liquid interface

Homepage: <http://www.plasma.ee.titech.ac.jp/>

1 Research Topics

1. Decomposition of persistent substances using plasma in water and recovery of worthwhile substances.
2. Investigation of physical and chemical phenomena in plasmas generated on gas-liquid interface

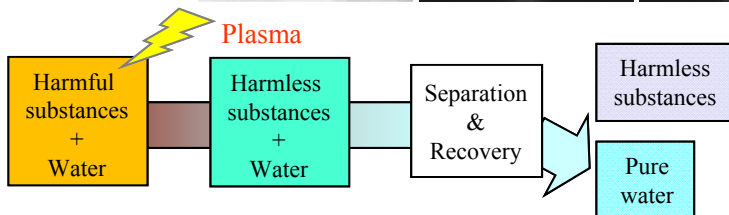
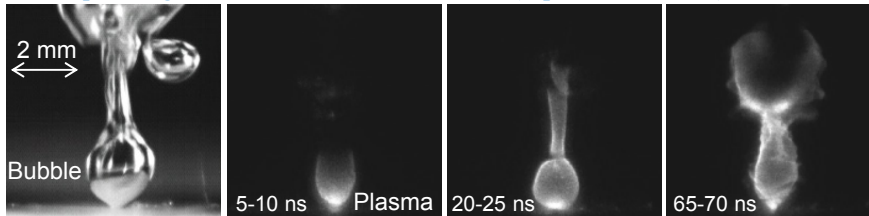
We are working on the investigation of fundamental reaction processes and practical applications of **plasmas in water**. **Advanced water reuse and recycling** have become a high-priority issue in the world following a shortage of water and worsening environmental problems. A large amount of water used in the automobile industry, semiconductor industry, and energy industry such as shale oil extraction contain various persistent substances and cause environmental pollution. We try to recognize social demands and conduct experiments related to practical applications to solve the water problems.

2 Recent Research Progress

Decomposition of persistent substances using plasma generated inside bubbles in water

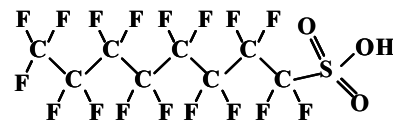
Injecting discharge gas through a hole of 150 μm in diameter forms gas bubbles in water. Applying a strong electric field inside the bubbles generates **plasma on gas-liquid interface**. Reactive species and high-energy species generated by the plasma can fully decompose harmful substances in water.

Pulsed plasma generated inside bubbles in water (exposure time: 5 ns)



Subject	Method		
	Ozone	Advanced oxidation process	Plasma
• Mold odor • Humic acid	☺	☺	☺
• PCB • Dioxine	☹	☺	☺
• Perfluoro compounds	☹	☹	☺

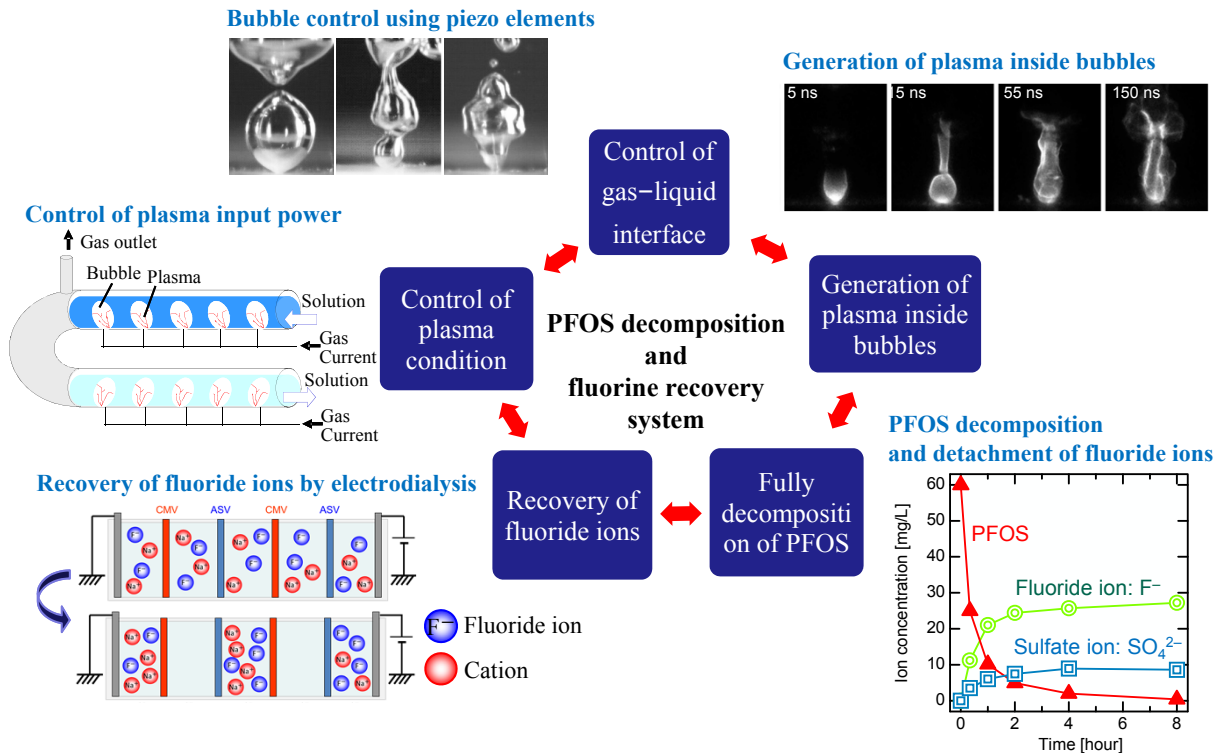
Perfluoro compounds PFOS (Perfluorooctane sulfonic acid)



- Surface active agent
- Persistent, bio-accumulative, and toxic compound
- Rapidly and efficiently decomposed by plasma generated inside bubbles in water

Rapid and efficient decomposition of PFOS and recovery of fluorine

PFOS can be decomposed rapidly and efficiently using plasma generated inside gas bubbles in water. Bubble generation and plasma input power are controlled to achieve more efficient decomposition system. Fluoride ions detached from PFOS are recovered by electrodiagnosis as a resource.



Fundamental reaction processes in plasma generated on gas-liquid interface

Fundamental reaction processes in plasma and liquid phase and on plasma-liquid interface have been investigated.

