Water Frontier Science & Technology Research Center

Period : from Nov. 22 / 2016 to Mar. 31 / 2021

Members (Department, FACULTY)

(Director)	Chemistry, SCI.	Hiroharu YUI	(Vice director)	Phys., SCI.	Yoshikazu HOMMA
(Group Leader)	Mech. Eng., ENG.	Shinya SASAKI	(Group Leader)	Appl. Chem., SCI.	Hidenori OTSUKA
(Group Leader)	Mech. Eng., SCI.& ENG.	Ichiro UENO	(Group Leader)	Liberal Arts, ENG.	Takahiro YAMAMOTO
(Group Leader)	Mech. Eng., ENG.	Masahiro MOTOSUKE	(Group Leader)	Appl. Chem., SCI.	Izumi NAKAI
(Member)	Pure & Appl.Chem., SCI.& ENG.	Hideki SAKAI	(Member)	Mech. Eng., SCI.& ENG.	Takahiro TSUKAHARA
	Mat. Sci.& Tach., IND. SCI.& ENG.	Masato KOTSUGI		Appl. Phys., SCI.	Tetsuaki ITO
	Phys., SCI.	Kazuhiko MIURA		Phys., SCI.	Eiji TOKUNAGA
	Chem., SCI.	Koichi TSUKIYAMA		Chem., SCI.	Makoto TADOKORO
	Ind. Chem., ENG.	Takeshi KAWAI		Ind. Chem., ENG.	Mineo HASHIZUME
	Appl. Phys., SCI.	Yutaka SUMINO		Appl. Elec., IND. SCI.& ENG.	Tadashi ANDO
	Photocatalysis Int. R. C., RIST	Chiaki TERASHIMA		RIST	Kenji SASAOKA
	RIST	Toshinori MORISAKU		RIST	Shuhei URASHIMA
(Guest Researcher)	Univ. Tokyo	Hirohumi DAIGUJI		Electro Communications Univ.	Takayoshi KOBAYASHI
	Osaka City Univ.	Tatsuru SHIRAFUJI		Tohoku Univ.	Hiroshi MATSUI
	Osaka Univ.	Yasutaka YAMAGUCHI		Mizuho Info.& Res. Inst. Inc.	Naotaka WATANABE
	Mizuho Info.& Res. Inst. Inc.	Koichiro KATO			

➢ **Objectives**

Contribution to both the deepening of basic researches and the development of the controlling technologies of water structures and dynamics (wetting and flow) at the surfaces of various materials that can be utilized in promoting energy saving through low-frictional machinery, regenerative medicine, and developing new devices and green technologies.

➢ **Research topics**

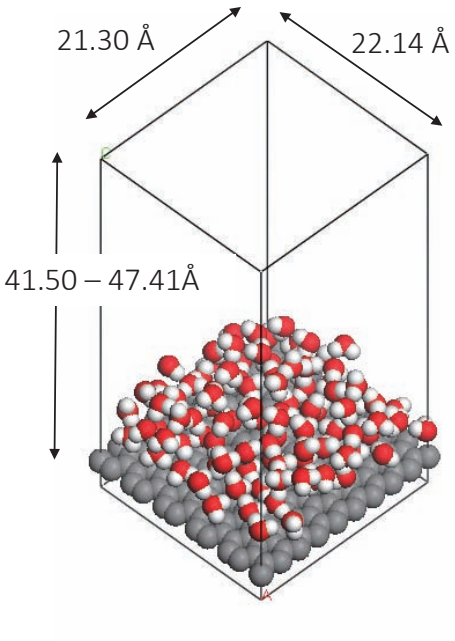
We study water on materials' surfaces through the following 6 concepts by corresponding group (G)s .

【G1】 Water on materials' surfaces: statistical thermodynamics and energy saving technologies
【G2】 Bio-interface: hydration structures of biocompatible hydropolymers for regenerative medicine
【G3】 Wetting and flow dynamics: basic researches and applications to material & energy technologies
【G4】 Theories and simulations: basic researches for multiscale structure and dynamics of water
【G5】 Measurements and controls on flow dynamics: for the development of novel fluidic devices
【G6】 Chemical reactions and analyses: advanced applications of water for green chemistry

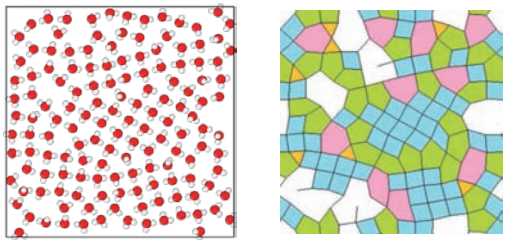
➢ **Activities until now and scheduled in future**

・Established in Nov. 2016 by the aid of the research promotion program by the MEXT Japan
・Kickoff meeting held in March 27 /2017
(Total: over 100 participants & 80 participants from companies and other research institutes.)
・International symposium of Water on Materials Surface (WMS2018) held in July 25-27/2018
(Total: 343 participants from companies and academic institutions.)
・Holding of annual educational lecture courses for graduate students in TUS & for public
・Promotion of synergetic researches and meetings between Intra & inter groups
・Promotion of industry & academia joint research meetings and collaborative researches

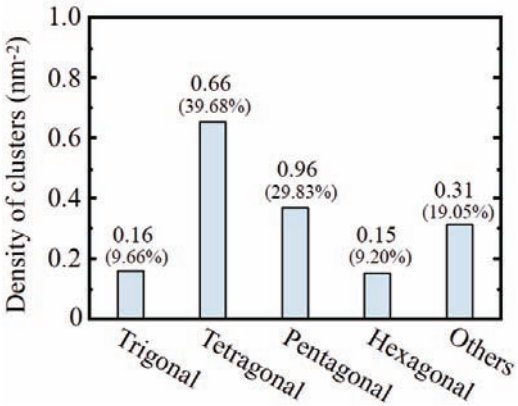
Topic ① Molecular Dynamics Simulation of water on graphite surface



MD Simulation model of water on graphite surface



Arrangement (left) and hydrogen-bond network (right) of interfacial water on graphite surface

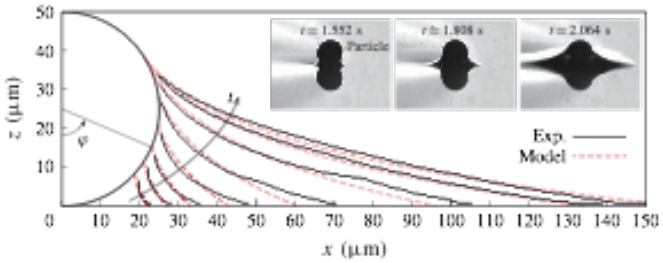


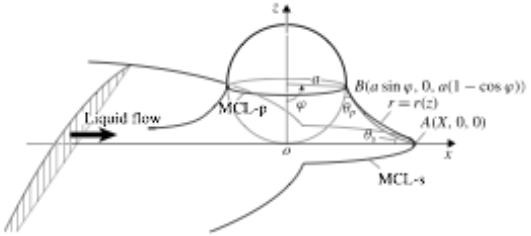
Histogram of the polygons of the interfacial water

Finding of the characteristic structures of microscopic water on graphite surface.

Y. Maekawa, K. Sasaoka, T. Yamamoto, *Jpn. J. Appl. Phys.* **57**, 035102, 2018.

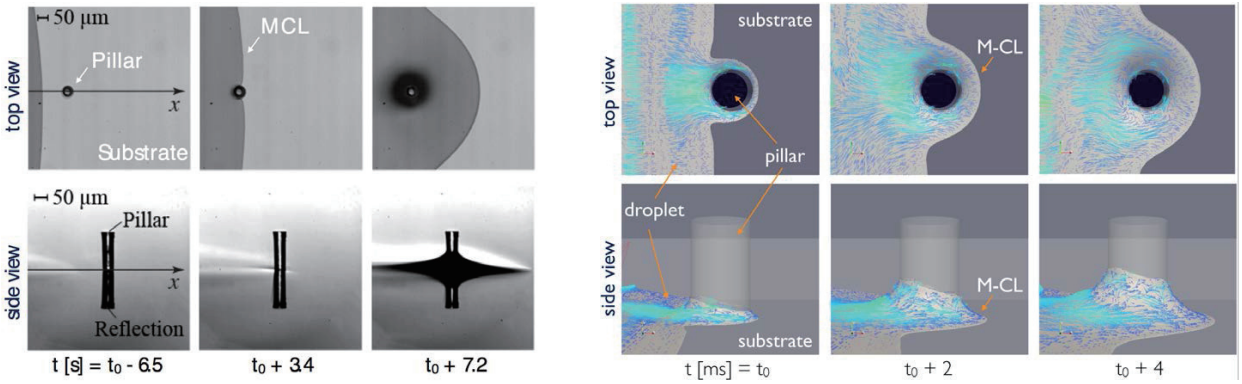
Topic ② Wetting dynamics of liquid film surrounding small structures





M-CL: Macroscopic contact line

1) Spherical particle[1]: Construction of a theoretical model and its comparison with experimental data.



2) Pillar : Experimental data (left) and their reproduction by numerical analysis (right).

Clarification of the acceleration dynamics in wettings of liquid films interacting with small particles and pillars on substrates.

[1] L. Mu, I. Ueno, et al. *J. Fluid Mech*. **830**, R1, 2017.