

研究業績

バイオAFM先端研究センター

研究論文

- N. Kodera, K. Uchida, T. Ando, S. Aizawa
Two-ball structure of the flagellar hook-length control protein FliK as revealed by high-speed atomic force microscopy, *J. Mol. Biol.* (in press).
- S. Ishino, T. Yamagami, M. Kitamura, N. Kodera, T. Mori, S. Sugiyama, T. Ando, N. Goda, T. Tenno, H. Hiroaki, Y. Ishino
Multiple interactions of the intrinsically disordered region between the N-terminal helicase and C-terminal nuclease domains of the archaeal Hef protein, *J. Biol. Chem.* Vol.289, pp.21627–21639 (2014).
- J. Preiner, N. Kodera, J. Tang, A. Ebner, M. Brameshuber, D. Blaas, N. Gelmann, H. Gruber, T. Ando, P. Hinterdorfer,
IgGs are made for walking on bacterial and viral surfaces”, *Nature Commun.* Vol.5, 4394 (8 pp) (2014).
- T. Ando
High-speed AFM imaging, *Curr. Opin. Struct. Biol.* Vol.28, pp.63–68 (2014).
- N. Kodera, T. Ando
The path to visualization of walking myosin V by high-speed atomic force microscopy, *Biophys. Rev.* Vol. 6, pp.237–260 (2014).
- Y. Shibafuji, A. Nakamura, T. Uchihashi, N. Sugimoto, S. Fukuda, H. Watanabe, M. Samejima, T. Ando, H. Noji, A. Koivula, K. Igarashi, R. Iino
Single-molecule imaging analysis of elementary reaction steps of *Trichoderma Reesei* cellobiohydrolase I (Cel7A) hydrolyzing crystalline cell. *J. Biol. Chem.* Vol.289, pp.14056–14065 (2014).
- T. Ando, T. Uchihashi, S. Scheuring
Filming biomolecular processes by high-speed atomic force microscopy, *Chem. Rev.* Vol.114, pp.3120–3188 (2014).
- Nakamura, H. Watanabe, T. Ishida, T. Uchihashi, M. Wada, T. Ando, K. Igarashi, M. Samejima
Trade-off between processivity and hydrolytic velocity of cellobiohydrolases at the surface of crystalline cellulose, *J. Am. Chem. Soc.* Vol.136, pp.4584–4592 (2014).
- K. Igarashi, T. Uchihashi, T. Uchiyama, H. Sugimoto, M. Wada, K. Suzuki, S. Sakuda, T. Ando, T. Watanabe, M. Samejima
Two-way traffic of glycoside hydrolase family 18 processive chitinases on crystalline chitin, *Nature Commun.* Vol.5, 3975 (7 pp) (2014).
- N. Numoto, T. Nakagawa, R. Ohara, T. Hasegawa, A. Kita, T. Yoshida, T. Maruyama, K. Imai, Y. Fukumori, K. Miki
The structure of a deoxygenated 400 kDa haemoglobin reveals ternary- and quaternary-structural changes of giant haemoglobins. *Acta Cryst.* Vol. D70, pp.1823–1831 (2014).
- A. Taoka, Y. Eguchi, S. Mise, Z. Oestreicher, F. Uno, Y. Fukumori
A magnetosome-associated cytochrome MamP is critical for magnetite crystal growth during the exponential growth phase. *FEMS Microbiol. Lett.* Vol.358, pp.21–29 (2014).
- A. Taoka, J. Kondo, Z. Oestreicher, and Y. Fukumori
Characterization of uncultured giant rod-shaped magnetotactic Gammaproteobacteria from a fresh water pond in Kanazawa, Japan. *Microbiology-SGM*. Vol.160, pp.2226–2234 (2014).
- W. Sato, R. Mizuuchi, N. Irioka, S. Komatsuda, S. Kawata, A. Taoka, Y. Ohkubo
Extranuclear dynamics of 111Ag (\rightarrow 111Cd) doped in AgI nanoparticles. *Chem. Phys. Lett.* Vol.609, pp.104–107 (2014).
- J. Jandaruang, J. Siritapetawee, C. Songsiriritthigul, S. Preecharram, A. Taoka, A. Dhiravosit, Y. Fukumori, S. Thammasirirak
Purification, characterization, and crystallization of *Crocodylus siamensis* hemoglobin. *Protein J.* Vol.33, pp.377–385 (2014).
- N. Sato, S. Ishii, H. Sugimoto, T. Hino, Y. Fukumori, Y. Sako, Y. Shiro, T. Toshia
Structures of reduced and ligand-bound nitric oxide reductase provide insights into functional differences in respiratory enzymes. *Proteins: Structure, Function and Bioinformatics* Vol.82, pp.1258–1271 (2014).
- A. Noguchi, A. Ikeda, M. Mezaki, Y. Fukumori, M. Kanemori
DnaJ-promoted binding of DnaK to multiple sites on σ^{32} in the presence of ATP. *J. Bacteriol.* Vol.196, pp.1694–1703 (2014).
- S. M. R. Akrami, H. Nakayachi, T. Watanabe-nakayama, H. Asakawa, T. Fukuma
Significant improvements in stability and reproducibility of atomic-scale atomic force microscopy in liquid, *Nanotechnology* Vol.25, 455701 (8 pp) (2014).
- N. Inada, H. Asakawa, Y. Matsumoto, T. Fukuma
Molecular-scale surface structures of oligo (ethylene glycol)-terminated self-assembled monolayers investigated by frequency modulation atomic force microscopy in aqueous solution, *Nanotechnology* Vol.25, 305602 (10 pp) (2014).
- H. Sakamoto, H. Asakawa, T. Fukuma, S. Fujita, S. Suya
Atomic force microscopy visualization of hard segment alignment in stretched polyurethane nanofibers prepared by electrospinning, *Sci. Technol. Adv. Mater.* Vol.15, 015008 (6 pp) (2014).
- K. Yoshida, Y. Matsuoka, S. Hara, H. Konno, T. Hisabori
Distinct redox behaviors of chloroplast thiol enzymes and their relationships with photosynthetic

- electron transport in *arabidopsis thaliana*, Plant Cell Physiol. Vol.55, pp.1415–1425 (2014).
- E. Sunamura, K. Kamei, H. Konno, N. Tamaoki, T. Hisabori
Reversible control of F1-ATPase rotational motion using a photochromic ATP analog at the single molecule level, Biochem. Biophys. Res. Commun. Vol.466, pp.358–363 (2014).
- M. H. Fauzi, S. Watanabe and Y. Hirayama
Nuclear magnetometry studies of spin dynamics in quantum Hall systems, Phys. Rev. B Vol.90, 235308 (8pp) (2014).
- K. Noi, D. Yamamoto, S. Nishikori, K. Arita-Morioka, T. Ando, T. Ogura
High-speed atomic force microscopic observation of ATP-dependent rotation of the AAA+ chaperone p97, Structure Vol.21, pp.1992–2002 (2013).
- N. Yilmaz, T. Yamada, P. Greimel, T. Uchihashi, T. Ando, T. Kobayashi
Real-time visualization of assembling of a sphingomyelin-specific toxin, Biophys. J. Vol.105, pp.1397–1405 (2013).
- S. Fukuda, T. Uchihashi, R. Iino, Y. Okazaki, M. Yoshida, K. Igarashi, T. Ando
High-speed atomic force microscope combined with single-molecule fluorescence microscope, Rev. Sci. Instrum. Vol.84, 073706 (8 pp) (2013).
- M. Hashimoto, N. Kodera, Y. Tsunaka, M. Oda, M. Tanimoto, T. Ando, K. Morikawa, S. Tate
Phosphorylation-coupled intramolecular dynamics of unstructured regions in chromatin remodeler FACT, Biophys. J. Vol.104, pp.2222–2234 (2013).
- H. Watanabe, T. Uchihashi, T. Kobashi, M. Shibata, J. Nishiyama, R. Yasuda, T. Ando
Wide-area scanner for high-speed atomic force microscopy, Rev. Sci. Instrum. Vol.84, 053702 (10 pp) (2013).
- T. Ando
High-speed atomic force microscopy of protein dynamics: myosin on actin and rotary enzyme F1-ATPase, Microscopy & Analysis Vol.27, pp.10–13 (2013).
- H. Yamashita, K. Inoue, M. Shibata, T. Uchihashi, J. Sasaki, H. Kandori, T. Ando
Role of trimer-trimer interaction of bacteriorhodopsin studied by optical spectroscopy and high-speed atomic force microscopy, J. Struct. Biol. Vol.184, pp.2–11 (2013).
- T. Ando
Molecular machines directly observed by high-speed atomic force microscopy, FEBS Lett. Vol.587, pp.997–1007 (2013).
- T. Ando, T. Uchihashi, N. Kodera
High-speed AFM and applications to biomolecular systems, Annu. Rev. Biophys. Vol.42, pp.393–414 (2013).
- T. Ando
High-speed atomic force microscopy, Microscopy Vol.62, pp.81–93 (2013).
- S. Sakaguchi, A. Taoka, Y. Fukumori
Analysis of magnetotactic behavior by swimming assay, Biosci. Biotech. Biochem. Vol.77, pp.940–947 (2013).
- M. Yamanaka, Y. Ishizaki, T. Nakagawa, A. Taoka, Y. Fukumori
Purification and characterization of coacervate-forming cuticular proteins from *Papilio xuthus* Pupae, Zoological Science Vol.30, pp.534–542 (2013).
- M. H. Fauzi, S. Watanabe, Y. Hirayama
Spin phase transition studies to probe spin dynamics in quantum hall system, J. Phys. Conf. Ser. Vol.456, 012010 (4 pp) (2013).
- K. Amano, K. Suzuki, T. Fukuma, O. Takatashi
H. Onishi
The relationship between local liquid density and force applied on a tip of atomic force microscope: A theoretical analysis.0 for simple liquids, J. Chem. Phys. Vol.139, 203104 (7 pp) (2013).
- N. Kobayashi, S. Itakura, H. Asakawa, T. Fukuma
Atomic-scale processes at the fluorite – water interface visualized by frequency modulation atomic force microscopy, J. Phys. Chem. C Vol.117, pp.24388–24396 (2013).
- K. Miyata, H. Asakawa, T. Fukuma
Real-time atomic-resolution imaging of crystal growth process in water by phase modulation atomic force microscopy at one frame per second, Appl. Phys. Lett. Vol.103, 203104 (4 pp) (2013).
- H. Asakawa, Y. Katagiri, T. Fukuma
Closed fluid cell with liquid-sealing mechanism for stable and flexible operation of liquid-environment atomic force microscopy, Jpn. J. Appl. Phys. Vol.52, 110109 (5 pp) (2013).
- K. Miyata, S. Usho, S. Yamada, S. Furuya, K. Yoshida, H. Asakawa, T. Fukuma
Separate-type scanner and wideband high-voltage amplifier for atomic-resolution and high-speed atomic force microscopy, Rev. Sci. Instrum. Vol.84, 043705 (8 pp) (2013).
- E. T. Herruzo, H. Asakawa, T. Fukuma, R. Garcia
Three-dimensional quantitative force maps in liquid with 10 piconewton, angstrom and sub-minute resolutions, Nanoscale Vol.5, pp.2678–2685 (2013).
- T. Hisabori, E. Sunamura, Y. Kim, H. Konno
The chloroplast ATP synthase features the characteristic redox regulation machinery, Antioxid. Redox. Signal. Vol.19, pp.1846–1854 (2013).
- J. Kishikawa, T. Ibuki, S. Nakamura, A. Nakanishi, T. Minamino, T. Miyata, K. Namba, H. Konno, H. Ueno, Imada, K. Yokoyama
Common evolutionary origin for the rotor domain of rotary ATPases and flagellar protein export ap-

- paratus, PLoS One Vol.8, e64695 (8 pp) (2013).
 T. Ando, T. Uchihashi, N. Kodera
 High-speed atomic force microscopy, Jpn. J. Appl. Phys. Vol.51, 08KA02 (15 pp) (2012).
- H. Yamashita, A. Taoka, T. Uchihashi, T. Asano, T. Ando, Y. Fukumori
 Single molecule imaging on living bacterial cell surface by high-speed AFM, J. Mol. Biol. Vol.422, pp.300–309 (2012).
- T. Uchihashi, N. Kodera, T. Ando
 Guide to video recording of structure dynamics and dynamic processes of proteins by high-speed atomic force microscopy, Nature Protocols Vol.7, pp.1193–1206 (2012).
- K. Igarashi, T. Uchihashi, A. Koivula, M. Wada, S. Kimura, M. Penttilä, T. Ando, M. Samejima
 Visualization of cellobiohydrolase I from Trichoderma reesei moving on crystalline cellulose using high-speed atomic force microscopy, Methods Enzymol. Vol.510, pp.169–182 (2012).
- T. Ando
 High-speed atomic force microscopy coming of age, Nanotechnology Vol.23, 062001 (27 pp) (2012).
- H. Suzuki, A. Ikeda, S. Tsuchimoto, K. Adachi, A. Noguchi, Y. Fukumori, M. Kanemori
 Synergistic binding of DnaJ and DnaK chaperone to the heat shock transcription factor σ^{32} assures its characteristic high metabolic instability: Implications for the heat shock protein 70 (Hsp70)–Hsp40 mode of function, J. Biol. Chem. Vol.287 pp.19275–19283 (2012).
- M. H. Fauzi, S. Watanabe, N. Kumada, Y. Hirayama
 All electrical probe of nuclear spin polarization and relaxation by spin phase transition peaks of the filling fraction $v = 2/3$ quantum Hall effect, J. Korean Phys. Soc. Vol.60, pp.1676–1679 (2012).
- M. H. Fauzi, S. Watanabe, Y. Hirayama
 Microscopic characteristics of dynamic nuclear polarization and selective nuclear depolarization at the $v = 2/3$ spin phase transition, Appl. Phys. Lett. Vol.101, pp.162015–1–162105–3 (2012).
- H. Asakawa, S. Yoshioka, K. Nishimura, T. Fukuma
 Spatial distribution of lipid headgroups and water molecules at membrane/water interfaces visualized by three-dimensional scanning force microscopy, ACS NANO Vol.6, pp.9013–9020 (2012).
- N. Kobayashi, H. Asakawa, T. Fukuma
 Dual frequency open-loop electric potential microscopy for local potential measurements in electrolyte solution with high ionic strength, Rev. Sci. Instrum. Vol.83, 033709 (7 pp) (2012).
- T. Fukuma, K. Onishi, N. Kobayashi, A. Matsuki, H. Asakawa
 Atomic-resolution imaging in liquid by frequency modulation atomic force microscopy using small cantilevers with megahertz-order resonance frequencies, Nanotechnology Vol.23, 135706 (12 pp) (2012).
- T. Nojima, H. Konno, N. Kodera, K. Seio, H. Taguchi, M. Yoshida
 Nano-scale alignment of proteins on a flexible DNA backbone, PLoS One Vol.7, e52534 (7 pp) (2012).
- H. Sunamura, H. Konno, M. Imashimizu, M. Mochimaru, T. Hisabori
 A conformational change of the γ subunit indirectly regulates the activity of cyanobacterial F₁-ATPase, J. Biol. Chem. Vol.287, pp.38695–38704 (2012).
- H. Konno, T. Nakane, M. Yoshida, H. Ueoka-Nakanishi, S. Hara, T. Hisabori
 Thiol modulation of the chloroplast ATP synthase is dependent on the energization of thylakoid membranes, Plant Cell Physiol. Vol.53, pp.626–634 (2012).

総説、解説、報告書

安藤敏夫

機能動作中のタンパク質分子を動画撮影する高速AFM, 実験医学(増刊) Vol.32, No.10, pp.45–49 (2014).

古寺哲幸, 内橋貴之, 安藤敏夫

高速原子間力顕微鏡による生体分子のナノ動体撮影, 日本物理学会誌 Vol.69, No.7, pp.459–464 (2014). 内橋貴之, 飯野亮太, 安藤敏夫, 野地博行

高速AFMによるF₁-ATPase分子回転の直接可視化, 生化学 Vol.86, No.2, pp.127–136 (2014).

福森義宏, 田岡東

磁性細菌オルガネラ「マグネットソーム」の構造機能相関の解明, 生物物理 Vol.54, No.1, pp.11–14 (2014). 福間剛士

原子間力顕微鏡による高速液中原子分解能観察の実現, 電気学会誌 Vol.134, pp.820–823 (2014).

安藤敏夫

高速原子間力顕微鏡—歩行運動中のミオシンの可視化, 生体の化学<特集>顕微鏡で物を見るこの新しい動き, Vol.64, No.6, pp.551–557 (2013).

安藤敏夫

高速原子間力顕微鏡によるバイオイメージング, 映像情報メディア学会誌<特集>バイオイメージ・インフォマティクス, Vol.67, No.9, pp.753–759 (2013).

安藤敏夫

総合報告: 原子間力顕微鏡の発展と今後の展望, 光学 Vol.42, No.2, pp.68–76 (2013).

内橋貴之, 安藤敏夫

最新装置開発: 高速AFM開発について, 精密工学会誌 Vol. 79, No.2, pp.218–222 (2013)

内橋貴之, 古寺哲幸

解説: リアルタイム原子間力顕微鏡の開発とたんぱく質の機能動態イメージング, 光学 Vol.42, No.2, pp.89–94 (2013).

福森 義宏

アトモスフィア：「生化学実験」と「モノづくり」のイノベーション，生化学 Vol.85, No.11, pp.959 (2013).

渡辺信嗣，安藤敏夫

報告書：次世代高速SPM装置の開発，金沢大学ベンチャー・ビジネス・ラボラトリ一年報2013, pp.27-28 (2013).

長谷部徳子，伊藤健太郎，福間剛士，大石新之介，金周龍

フィッショントラック年代測定における多様化する観察法，号外地球 Vol.62, pp.124-128 (2013).

福間剛士

液中周波数変調AFMを用いた固液界面構造の三次元計測，表面科学 Vol.34, pp.476-481 (2013).

安藤敏夫

ナノメータ世界の動態を動画撮影する高速AFM, O plus E 特集：最新AFM技術, Vol.34, No.3, pp.217-222 (2012).

著書

T. Uchihahsi, N. Kodera, T. Ando

Development of high-speed AFM and its biological applications. Chapter 8, pp.143-176 in Atomic Force Microscopy in Nanobiology (K. Takeyasu Ed.) Pan Stanford Publishing, Singapore (2014).

T. Ando, T. Uchihashi

High-speed AFM and imaging of biomolecular processes, Chapter 19, pp.713-742 in Nanoscale Liquid Interfaces: Wetting, Patterning, and Force Microscopy at the Molecular Scale (T. Ondarcuhu, J.-P.e Aimé Eds.), Pan Stanford Publishing (2013).

T. Uchihashi, N. Kodera, T. Ando

Nanovisualization of proteins in action using high-speed AFM, Chapter 5, pp.119-147 in Single-molecule Studies of Proteins. Biophysics for the Life Sciences Vol.2, (A. Oberhauser, Ed.), Springer (2013).

T. Fukuma

Atomic-resolution frequency modulation, Chapter 13, pp.237-252 in Fundamentals of Picoscience (K. D. Sattler Ed.) CRC Press, London (2013).

T. Fukuma

Molecular-resolution FM-AFM imaging of biological systems, Chapter 18, pp.681-712 in Nanoscale Liquid Interfaces (T. Ondarcuhu, J.-P. Aimé Eds.) Pan Stanford Publishing, Singapore (2013).

T. Ando, N. Kodera

Visualization of mobility of atomic force microscopy Chapter 4, pp.57-69 in Springer series Methods in Molecular Biology, Vol. 897, part 1 Experimental Tools for the Intrinsically Disordered Protein Analysis (V. N. Uversky and A. K. Dunker, Eds.), Springer (2012).

T. Ando, T. Uchihashi, N. Kodera, M. Shibata,

D. Yamamoto, H. Yamashita,

High-speed AFM for observing dynamic processes in liquid, Chapter 7, pp.189-209 in Atomic force microscopy in liquid (A. N. Baró and R. G. Reifenberge Eds.), Wiley-VCH Verlag GmbH (2012).

T. Fukuma, M. J. Higgins

Dynamic-mode AFM in liquid, Chapter 4, pp. 87-120 in Atomic Force Microscopy in Liquid (A. M. Baro, R. G. Reifenberger Eds.) WILEY-VCH (2012).

安藤敏夫

19章 ナノ動態を捉える高速AFM, pp.239-251 in 1分子生物学 (原田慶恵・石渡信一編集) 化学同人 (2014).

内橋貴之, 安藤敏夫

23章 原子間力顕微鏡による膜タンパク質のダイナミクス研究, pp.196-203 in 膜タンパク質構造研究 (岩田想編集), 化学同人 (2013).

安藤敏夫

5.2節, 高速AFMによるタンパク質1分子挙動解析, pp. 170-182 in 試料分析講座 タンパク質分析 (日本分析化学会編) 丸善出版 (2012).

安藤敏夫

Part II 研究生前線 第2章 高速AFMによる1分子タンパク質解析, pp.48-54 in ここまで進んだバイオセンシング・イメージング - 1分子から細胞、脳まで (日本化学会編集) 化学同人 (2012).

福間剛士

4.6節, 原子間力顕微鏡, pp.88-91 in 先端バイオマテリアルハンドブック (秋吉一成, 石原一彦, 山岡哲二監修) NTS (2012).

特許, 實用新案

安藤敏夫, 福田真悟

走査型プローブ顕微鏡, 特願2014-194987 (2014).

浅川雅, 福間剛士, 小林大貴

走査型プローブ顕微鏡用カンチレバー及び走査型プローブ顕微鏡, 特願2014-031312 (2014).

本棒享子, 大橋健也, 池田光晴, 福間剛士, 小林成貴, 尾形獎一郎

液中電位計測技術を用いた金属の耐食性評価方法及び評価装置, PCT/JP2013/069728 (2013).

福間剛士, 宮田一輝

信号検出回路及び走査型プローブ顕微鏡, 特願2013-070575 (2013).