Annual Report 2003
Main Data

1. Papers Published

- Advanced Materials Laboratory
- Nanomaterials Laboratory
- Materials Engineering Laboratory
- Biomaterials Center
- Superconducting Materials Center
- Computational Materials Science Center
- Steel Research Center
- Ecomaterials Center
- High Magnetic Field Center
- Materials Information Technology Station
- Materials Analysis Station

2. Implementation of patents

- 2.1 The Registered Patent (Foreign Patent)
- 2.2 Summary of the Licensing fee Income (2003 Fiscal Year)

3. International Cooperation

4. Public Relations

- International Conference, Seminar

5. Publications

6. Land Area and Building Area

1. Papers Published

< Advanced Materials Laboratory >

No.	Publications Name
1.	K. Takemura, K. Sato, Hiroshi F, M. Onoda:Modulated structure of solid iodine during its molecular dissociation under high pressure:Nature,423(6943)971-974(2003)
2.	K. Tomeoka, K. Kiriyama, K. Nakamura, Y. Yamahana, T. Sekine:Interplanetary dust from the explosive dispersal of hydrated asteroids by impacts:Nature,423(6935)60-62(2003)
3.	K. Takada, Y. Sakurai, E. Muromachi, F. Izumi, R. A. Dilanian, T. Sasaki:Superconductivity in two-dimensional CoO2 layer:Nature,422(6927)53-55(2003)
4.	JQ. Hu, Y. Bando, D. Golberg, L. Quanlin:Gallium Nitride Nanotubes by the Conversion of Gallium Oxide Nanotubes:Angew. Chem.-Int. Edit.,42,3493-3497(2003)
5.	RZ. Ma, Y. Bando, G. Dmitri, T. Sato:Nanotubes of Magnesium Borate:Angew. Chem.-Int. Edit.,42,1836-1838(2003)
6.	Y. B. Li, Y. Bando, D. Golberg:Indium-Assisted Growth of Aligned Ultra-Long Silica Nanotubes:Adv. Mater.,16(1)37-40(2003)
7.	M. Terrones, D. Golberg, N. Grobert, T. Seeger, M. Reyes-Reyes, M. Mayne, R. Kamalakaran, P. Dorozhkin, Z. Dong, H. Terrones, M. Ruhle, Y. Bando:Production and state-of-the-art characterization of aligned nanotubes with homogeneous BCxN (1 < x < 5) compositions:Adv. Mater.,15(22)1899-1903(2003)
8.	LG. Yin, Y. Bando, M.S. Li, Y.X. Liu, Y.X. Qu:Unique SIngle-Crystalline Beta Carbon Nitride Nanorods:Adv. Mater.,15(21)1840-1844(2003)
9.	Y. B. Li, Y. Bando, D. Golberg:Quasi-Aligned SIngle-Crystalline W18O29 Nanotubes and Nanowires:Adv. Mater.,15(15)1294-1296(2003)
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11.	JQ. Hu, Y. Bando, ZW. Liu:Synthesis of Gallium-Filled Gallium Oxide-Zinc Oxide:Adv. Mater.,15(12)1000-1003(2003)
12.	Y. B. Li, Y. Bando, D. Golberg:Single-crystalline In2O3 nanotubes filled with In:Adv. Mater.,15(7-8)581-585(2003)
13.	ZW. Liu, Y. Bando, :A novel method for preparing copper nanorods and nanowires:Adv. Mater.,15(4)303-305(2003)
14.	JH. He, I. Ichinose, T. Kunitake, A. Nakao, Yukihide Shiraishi, N. Toshima:Facile Fabrication of Ag-Pd Biometallic Nanoparticles in Ultrathin TiO2-gel Films: Nanoparticles Morphology and Catalitic Activity:J. Am. Chem. Soc.,125(36)11034-11040(2003)
15.	Ying-chun Zhu, Y. Bando, D.F. Xue, D. Golberg:Nanocable-Aligned ZnS Tetrapod Nanocrystals:J. Am. Chem. Soc.,125(52)16196-16197(2003)
16.	Ying-chun Zhu, Y. Bando, D.F. Xue, F. F. Xu, D. Golberg:Insulating Tubular BN Sheating on Semiconducting Nanowires:J. Am. Chem. Soc.,125(47)14226-14227(2003)
17.	JQ. Hu, Y. Bando, Z. Liu, T. Sekiguchi, D. Golberg, J. Zhan:Epitaxial Heterostructures:Side-to-Side Si-ZnS, Si-ZnSe Biaxial Nanowires, and Sandwichlike ZnS-Si-ZnS Triaxial Nanowires:J. Am. Chem. Soc.,125(37)11306-11313(2003)
18.	F. F. Xu, Y. Bando, RZ. Ma, D. Golberg, Y. B. Li, M. Mitome:Formation, Structure, and Structural Properties of a New Filamentary Tubular Form: Hollow Concical-Helix of Graphitic Boron Nitride:J. Am. Chem. Soc.,125(26)8032-8038(2003)
19.	Y.Q. Zhu, T. Sekine, K.S. Brigatti, S. Firth, R. Tenne, R. Rosentsveig, H.W. Kroto, D.R. Walton:Shock-wave resistance of WS2 nanotubes:J. Am. Chem. Soc.,125,1329-1333(2003)
20.	Y. Omomo, T. Sasaki, LZ. Wang, M. Watanabe:Redoxable Nanosheet Crystallites of MnO2 Derived via Delamination of a Layered Manganate Oxide:J. Am. Chem. Soc.,125(12)3568-3575(2003)
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22.	L. Quanlin, T. Tanaka, JQ. Hu, F. F. Xu, T. Sekiguchi:Green emission from c-axis oriented AlN nanorods doped with Tb:Appl. Phys. Lett.,83(24)4939-4941(2003)
23.	K. Kimoto, Y. Matsui, N. Nabatame, T. Yasuda, T. Mizoguchi, I. Tanaka, A. Toriumi:Coordination and interface analysis of atomic-layer-deposition Al2O3 on Si(001) using energy-loss near-edge structures:Appl. Phys. Lett.,83(21)4306-4308(2003)
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26.	CC. Tang, Y. Bando, :Effect of BN coatings on oxidation resistance and field emission of SiC nanowires:Appl. Phys. Lett.,83(4)659-661(2003)
27.	Y. B. Li, Y. Bando, D. Golberg, Y. Uemura:SiO2-sheathed InS nanowires and SiO2 nanotubes:Appl. Phys. Lett.,83(19)3999-4001(2003)
28.	JQ. Hu, Y. Bando, JH. Zhan, Y. B. Li, T. Sekiguchi:Two-dimensional micrometer-sized single-srustalline ZnO thin nanosheets:Appl. Phys. Lett.,83(21)4414-4416(2003)
29.	Y. Gao, Y. Bando, ZW. Liu, D. Golberg:Temperature measurement using a gallium-filled carbon nanotube nanothermometer:Appl. Phys. Lett.,83(14)2913-2915(2003)

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31.	N. Ohashi, K. Kataoka, T. Oogaki, T. Miyagi, H. Haneda, K. Morinaga:Synthesis of zinc oxide varistors with a breakdown voltage of three volts using an intergranular glass phase in the bismuth-boron-oxide system:Appl. Phys. Lett.,83(23)4857-4859(2003)
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34.	S. Kohiki, S. Nogami, S. Kawakami, S. Takada, H. Shimooka, H. Deguchi, M. Mitome, M. Oku:Large frequency dependence of lowered maximum dielectric constant temperature of LiTaO3 nanocrystals dispersed in mesoporous silicate:Appl. Phys. Lett.,82(23)4134-4136(2003)
35.	L. Youwen, K. Kitamura, S. Takekawa, M. Nakamura, Y. Furukawa, H. Hatano:nonvolatile two-color holographic recording in nondoped near-stoichiometric lithium tantalate cystals with continuous-wave lasers:Appl. Phys. Lett.,82(24)4218-4220(2003)
36.	Yu Nan Ei, S. Kurimura, K. Kitamura, JH. Ro, MS. Cha, S. Ashihara, T. Shimura, K. Kuroda, T. Taira:Efficient frequency doubling of a femtosecond pulse with simultaneous group-velocity matching and quasi phase matching in periodically poled, MgO-doped lithium niobate:Appl. Phys. Lett.,82(20)3388-3390(2003)
37.	K. Wada, T. Taniguchi, H. Kanda, E. M. Shishonok:Polarized Raman scattering of impurity modes in beryllium-doped cubic boron nitride single crystals:Appl. Phys. Lett.,82(16)2972-2974(2003)
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45.	K. Nakagawa, M-A. Yamagishi, H. Nishimoto, N. Ikenaga, T. Suzuki, T. Kobayashi, M. Gamo, T. Ando:Oxidized Diamond as a Simultaneous Production Medium of Carbon Nanomaterials and Hydrogen for Fuel Cell:Chem. Mat.,15,4571-4575(2003)
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53.	T. Kobayashi, T. Sekine, HL. He:Formation of carbon onion from heavily shocked SiC:Chem. Mat.,15(14)2681-2683(2003)
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59.	K. Nakagawa, C. Kajita, N. Ikenaga, T. Kobayashi, M. Gamo, T. Ando:The Role of Chemisorbed Oxygen on Diamond Surfaces for the Dehydrogenation of Ethane in the Presence of Carbon Dioxide:J. Phys. Chem. B,107,4048-4056(2003)
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81.	M. Umehara:Stability of the self-trapped exciton magnetic polaron in diluted magnetic semiconductors: Cd1-xMnxTe:Phys. Rev. B,67(3)035201-1-035201-11(2003)
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7.	S. Tanuma, T. Kimura :Quantitative Auger and X-Ray Photoelectron Analysis of Au-Cu alloys with Three kinds of Relative Sensitivity Factors:J. Surf. Anal.,10(2)163-168(2003)

2. Implementation of Patents

2.1 The Registered Patent (Foreign Patent)

No.	Title of the invention	Registration country	Date of Patent	Patent number
1.	Method of quickly decomposing and removing an organic chlorine compound by a hollandite-type photocatalyst	U.S.A	H15.4.8	6,544,426
2.	Method of evaluating high fatigue strength material in high tensile strength steel and creation of high fatigue strength material	U.S.A	H15.4.15	6,546,808
3.	Method of forming patterned thin film	U.S.A	H15.4.15	6,548,412
4.	Rotary body and quantum electric motor (Joint owner: Japan Science and Technology Corporation)	TAIWAN	H15.4.20	176642
5.	Boride-based substrate for growing semiconducting layers thereon and a semiconductor device using the same (Joint owner: corporation)	U.S.A	H15.5.20	6,566,218
6.	Method of producing oxide superconductive composite material	U.S.A	H15.5.27	6,569,813
7.	Production method of Nb3Al superconducting multifilamentary wire	U.S.A	H15.5.27	6,570,096
8.	Fine ferrite-based structure steel production method	U.S.A	H15.6.3	6,572,716
9.	Silicon nitride sintered products and processes for their production	U.S.A	H15.6.17	6,579,819
10.	High-strength metal solidified material and acid steel and manufacturing methods thereof (Joint owner: corporation)	TAIWAN	H15.7.17	173481
11.	Process for producing catalyst for steam reforming of methanol	U.S.A	H15.7.8	6,589,909
12.	Spinel type sialon, spinel type silicon oxynitride and methods for producing their powders	U.S.A	H15.7.8	6,589,899
13.	Adsorbent for nitrogen oxides and its treatment method	U.S.A	H15.7.15	6,592,841
14.	Method for reactive ion etching and apparatus therefore (Joint owner: Japan Science and Technology Corporation)	KOREA	H15.9.1	397860
15.	Ultra-fine grain steel and method for producing it	CHINA	H15.9.17	ZL98120620.4
16.	Optically functional device, single crystal substrate for the device and method for its use	U.S.A	H15.9.23	6,624,923
17.	Oxynitride phosphor activated by a rare earth element, and sialon type phosphor	U.S.A	H15.10.14	6,632,379
18.	Consumable electrode gas shielded arc welding method and apparatus (Joint owner: corporation)	U.S.A	H15.11.25	6,653,594
19.	Methods of producing ruthenium perovskite	U.S.A	H15.12.2	6,656,872
20.	Production method of ultra fine grain steel	CHINA	H15.12.17	ZL00102662.3
21.	Nickel-base single-crystal superalloys, method of manufacturing same and gas turbine high temperature parts made thereof (Joint owner: corporation)	U.S.A	H16.1.6	6,673,308
22.	Single crystal of lithium niobate or tantalate and its optical element, and process and apparatus for producing an oxide single crystal	U.S.A	H16.1.6	6,673,330
23.	Postweld heat treatment process of carbon steel and low alloy steel	U.S.A	H16.1.13	6,676,777
24.	Method of forming high temperature superconducting josephson junction	U.S.A	H16.1.27	6,682,621
TOTAL			24	

2.2 Summary of the Licensing fee Income (2003 Fiscal Year)

No.	Abstract	Patent number	Remarks
1.	Process for Producing Fine Metal Particles	U.S.A. Patent 4376740 (and 3 Patents)	
2.	Nickel-Based Single Crystal Alloy	Application No.09-316111	
3.	High-Temperature Oxide Superconductor	Application No.07/293465 (and 19 Patents)	
Number of license: 3		Total 1,688	

Description of New Issue (2003 Fiscal Year)

No.	Abstract	Application number	Remarks
1.	High-Temperature Oxide Superconductor	Application No.07/293465 (and 19 Patents)	

3. International Cooperation

For NIMS, which intends to become one of the world's COE (centers of excellence) in materials research, international cooperation and exchanges with the world's leading research institutes are indispensable. Because NIMS is now an independent administrative institution (IAI), it can enter into cooperative arrangements with foreign institutes at its own discretion, and as a result, the number of concluded agreements of various types and number of non-Japanese employed in research at NIMS are both increasing rapidly. Measures for international cooperation implemented to date include general agreements on comprehensive research cooperation and memorandums of understanding (MOU) on individual research topics with top class research institutes, and the international joint graduate school programs with leading universities. In FY2003, NIMS concluded new comprehensive cooperation agreements with the University of Cambridge (U.K.), ETHZ (Switzerland), and CNRS (France). International collaborations between individual researchers have also become increasingly common, and NIMS concluded 25 MOU for individual research in FY2003 alone, for a total of 43 to date. Under alliances with international joint graduate schools, NIMS received 5 students from Charles University in the Czech Republic as Phase 2, and will begin receiving students from the league of five Australian Universities in FY2004 under a similar agreement.

Cooperation under MOU
NIMS has concluded MOU and is now engaged in joint research with 43 institutes in Europe, the U.S., Asia, etc. Europe: 18, Korea: 10, U.S.: 8, India, China: 2 each, Singapore, Thailand, Australia: 1 each

Sister Institutes
Max Planck Institute for Metals Research (Germany), NIST-MSEL (U.S.), University of Cambridge (U.K.), ETHZ (Switzerland), CNRS (France)

Joint Graduate Schools
Charles University (Czech Rep.), Five Australian Universities (Sydney, Queensland New S. Wales, Melbourne, W. Australia Univs.)

The number of NIMS researchers resident overseas in FY 2003 is 10. The numbers of participants to international conferences and NIMS researchers going on overseas surveys in FY 2003 are 531 and 181, respectively and the distributions of financial sources for those are listed in Tables 1 and 2. On the other hand, NIMS accepted 159 foreign researchers in FY 2003 and the distributions of sponsorship and citizenship for those and are listed in Tables 3 and 4.

Table 1 Participants to International Conferences: Classified by Sponsorship

Sponsorship	#
Subsidy for Operation	432
Funds by MEXT	6
Special Coordination Funds for Promoting Science and Technology	25
Funds by External Organization	39
Invited	6
JSPS	6
JST Core Research for Evolutional Science and Technology	14
Others	3
Total Number	531

Table 2 Overseas Surveys: Classified by Sponsorship

Sponsorship	#
Subsidy for Operation	98
Funds by MEXT	16
Special Coordination Funds for Promoting Science and Technology	28
Funds by External Organization	11
Invited	16
JSPS	7
JST Core Research for Evolutional Science and Technology	1
Others	4
Total Number	181

Table 3 Foreign Researchers: Classified by Sponsorship

Sponsorship	#
Subsidy for Operation	11
International Joint Graduate School	9
Funds by MEXT	16
Special Coordination Funds for Promoting Science and Technology	17
JSPS:Long	34
JSPS:Short	7
JSPS:Others	5
Summer Program	1
Winter Institute	2
REES Program	0
Funds by External Organization	47
Funds by JST	10
Total Number	159

Table 4 Foreign Researchers: Classified by Citizenship

Country	#	Country	#
Australia	4	Korea	20
Austria	1	Nepal	1
Bangladesh	1	P.R.China	40
Canada	2	Poland	3
Czech	8	Russia	5
England	11	Saudi Arabia	1
France	5	Slovakia	1
Germany	9	Spain	2
Hangary	1	Sweden	1
Holland	1	Swiss	5
India	10	Taiwan	1
Iran	1	Thai	2
Israel	1	U.S.A.	14
Italia	2	Ukraine	6
Total Number			159

4. Public Relations
International Conference, Seminar

Title	Date	Place
Seventh Workshop on the Ultra-Steel "Ultra Stell:Requirements from New Design of Constructions"	June 24-25, 2003	Tsukuba International Congress Center
Workshop on Nanotechnology Networking and International Cooperation (IUMRS-ICAM2003)	October 11-12, 2003	Pacifico Yokohama
18th International Conference on Magnet Technology(MT-18)	October 20-24, 2003	Hotel Metropolitan Morioka
1st International Symposium on Active Nano- Characterization and Technology	November 11-14, 2003	NIMS Sengen Site
NML Seminor:Prof. Flemming Besenbacher of Interdisciplinary Nanoscience Center (iNANO), Denmark	November 20, 2003	NIMS Sengen Site
The 2nd NIMS International Conference on Photocatalysis:Fundamentals and Applications	February 1-3, 2004	Shonan Village Center
International Workshop on Progress of Nb-Based Superconductors	February 2-3, 2004	NIMS Sengen Site
9th International Symposium on Advanced Physical Fields(APF9)"Characterization of Artificial NanoStructures and Nanomaterials"	March 1-4, 2004	NIMS Sengen Site
The 11th International Symposium on Advanced Materials -Frontier of Nano-Materials and Colloid Chemistry-	March 7-10, 2004	Toshi Center Hotel
The 3rd International Symposium on Smart Materials and Systems	March 10, 2004	Tsukuba International Congress Hall
The 2nd Japan-China Workshop on Automobile Materials for Environment and Safety	March 11, 2004	NIMS Sengen Site
The 2nd BMC-NIMS Symposium Fusion of Medicine and Biomaterials for Supporting a Healthy and Safe Society	March 12-13, 2004	Tsukuba International Congress Hall
Announcement of MITS meeting 2004	March 15-17, 2004	NIMS Sengen Site

5. Publications
International Conference, Seminar

1. NIMS 2004 (Japanese, 1/year)
2. NIMS 2004 International (English, 1/year)
3. National Institute for Material Science: Structural Materials Datasheets (published as required)

   (1)Creep Datasheet (English)

   (2)Fatigue Datasheet (English)

   (3)Corrosion Datasheet (English)

   (4)Space Use Materials Strength Datasheet (English)

   (5)Structural Materials Datasheet Materials (Japanese)
4. NIMS NOW (Japanese, published monthly)
5. NIMS NOW International (English, published monthly)
6. Pamphlet (Japanese/English bilingual, published as required)

6. Land Area and Building Area

1.Land Area 31-March-2004

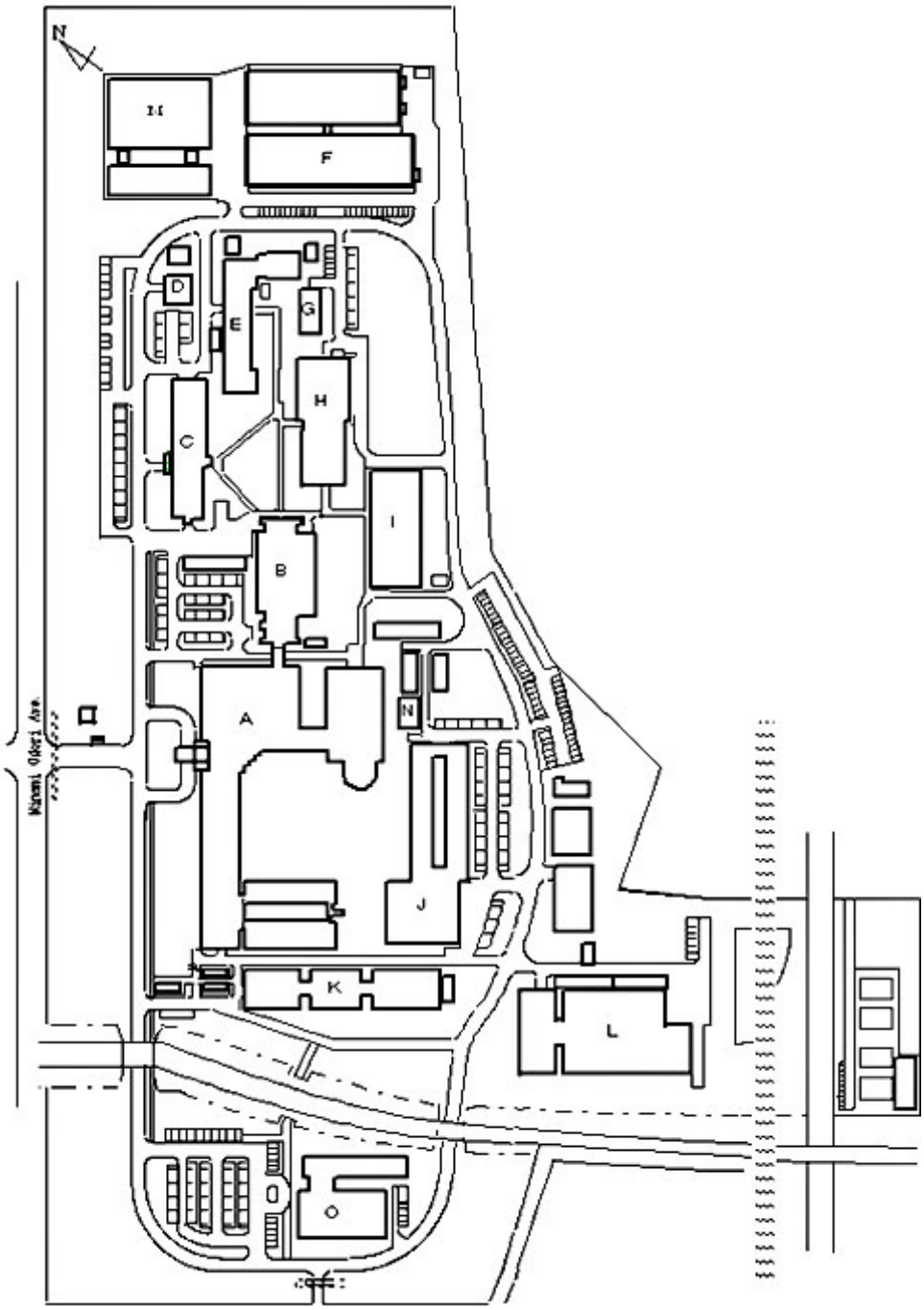
Site	Land Area(m^2)	Notes
Sengen Site	149,839	
Namiki Site	152,791	
Sakura Site	44,031	
Meguro Site	5,102	
Total	351,763	

2. Building Area 31-March-2004

Site	Building Area(m^2)	Total Floor Space(m^2)	Notes
Sengen Site	29,422	65,287	
Namiki Site	19,254	43,804	
Sakura Site	9,488	17,722	
Meguro Site	2,855	7,708	
Total	61,019	134,521	

Disposition
Sengen Site

Land Area	149,839m^2
Building Area	29,422m^2
Total Floor Space	65,287m^2

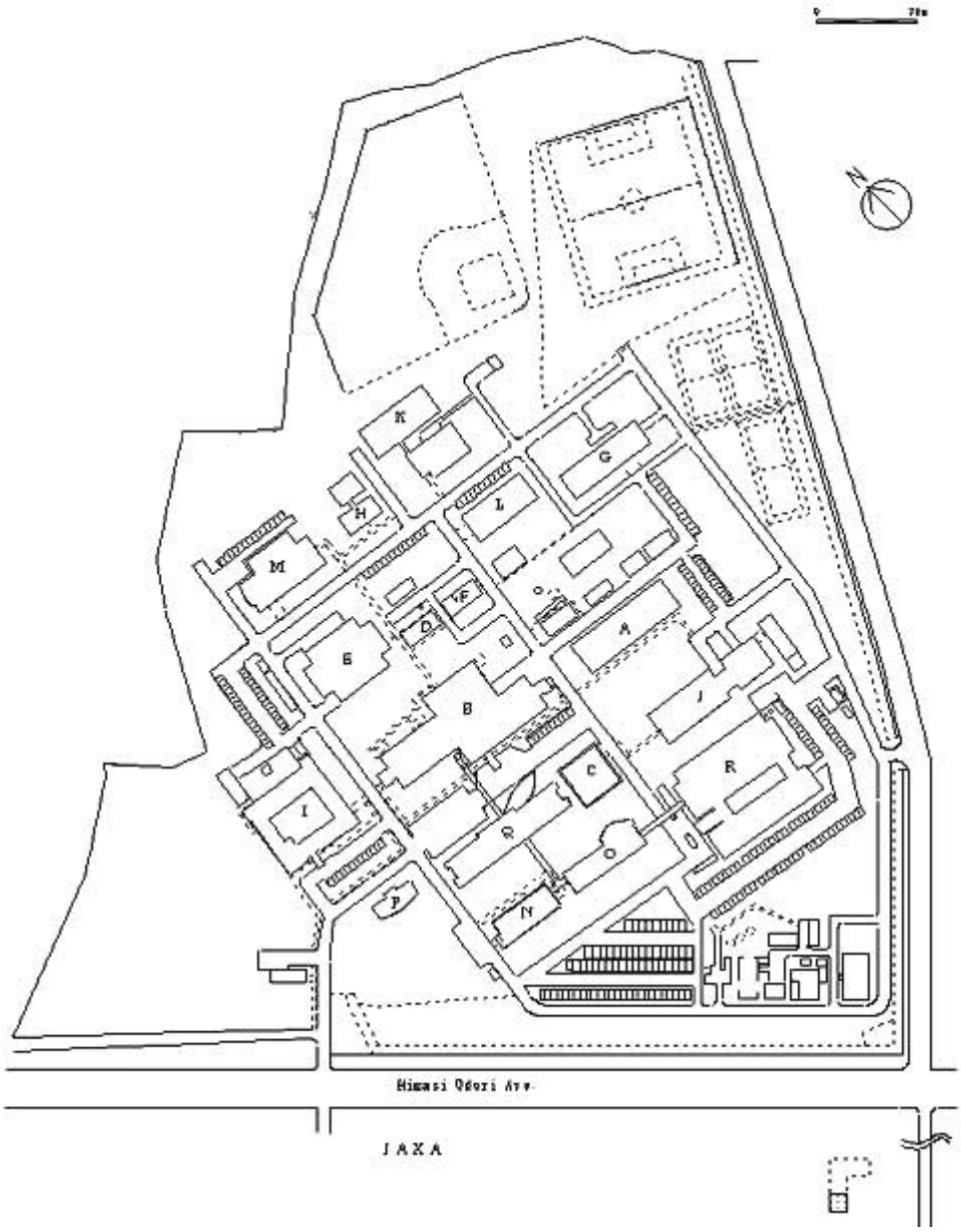


A Central Building
B Materials Evaluation Laboratories
C Superconducting Materials Laboratories
D Magnetic Properties Laboratories
E Environmental Effects Laboratories
F Materials Preparation Factory
G Special Materials Laboratories
H Interface Science Laboratories
I Structural Materials Laboratories
J Fine Processing Laboratories
K Physical Analysis Laboratories
L Mechanical Testing Laboratories
M Structures Control Laboratories
N Welfare Building
O Materials Reliability Laboratories

31-March-2004

Disposition
Namiki Site

Land Area	152,791m^2
Building Area	19,254m^2
Total Floor Space	43,804m^2

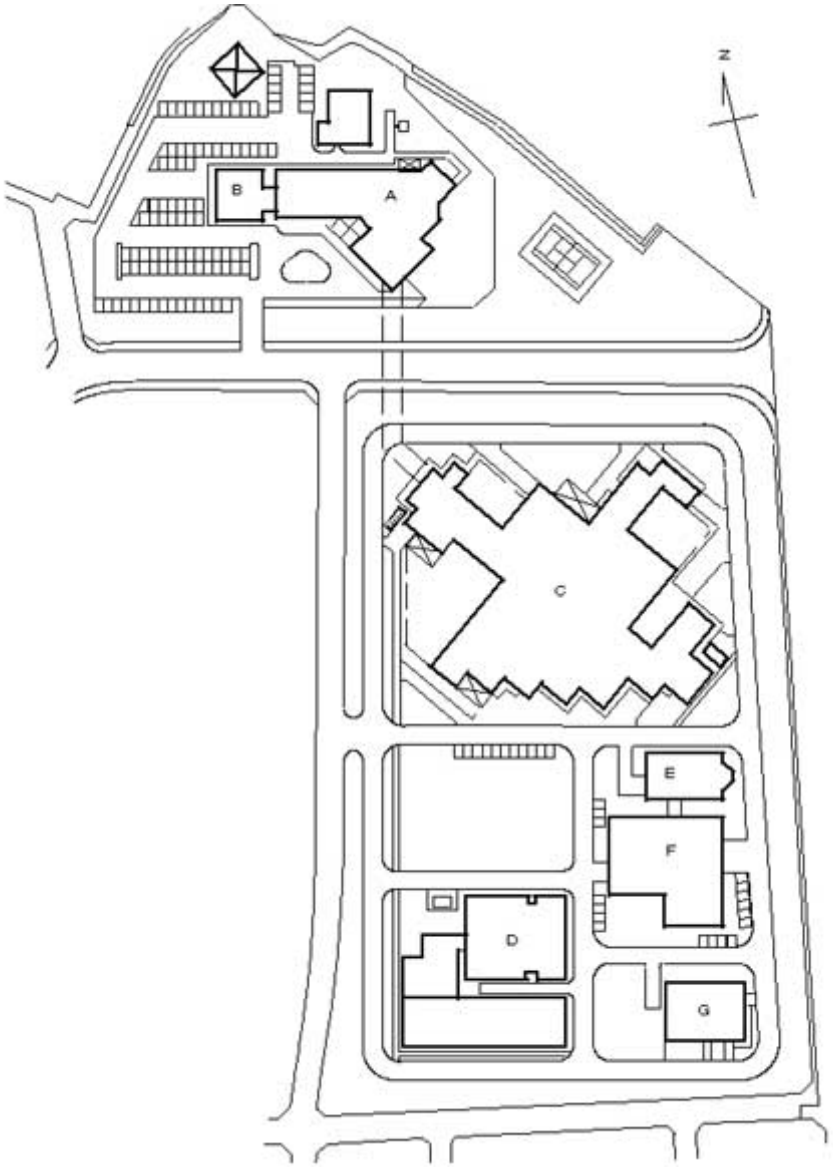


A High Pressure Laboratory
B Main Research Building
C Welfare Building
D Helium Liquefier Facility
E High Temperature Synthesis Laboratory
F Positron Annihilation Laboratory
G Clean Laboratory
H High Voltage Electron Microscope Laboratory
I Administration Building
J Extreme Technology Laboratory
K Quake-Free Laboratory
L Superconducting Ceramics Laboratory
M Ion Beam Applications Laboratory
N Advanced Materials Laboratory
O Ultimate Analysis Laboratory
P Libraly
Q Collaborative Research Building
R Nanomaterials and Biomaterials Research Building

31-March-2004

Disposition
Sakura Site

Land Area	44,031m^2
Building Area	9,488m^2
Total Floor Space	17,722m^2



A Central Office

B Nanotecnology Collaborative Building

C High Magnetic Field Laboratories

D High Resolution Beam Laboratories

E NMR Laboratory I

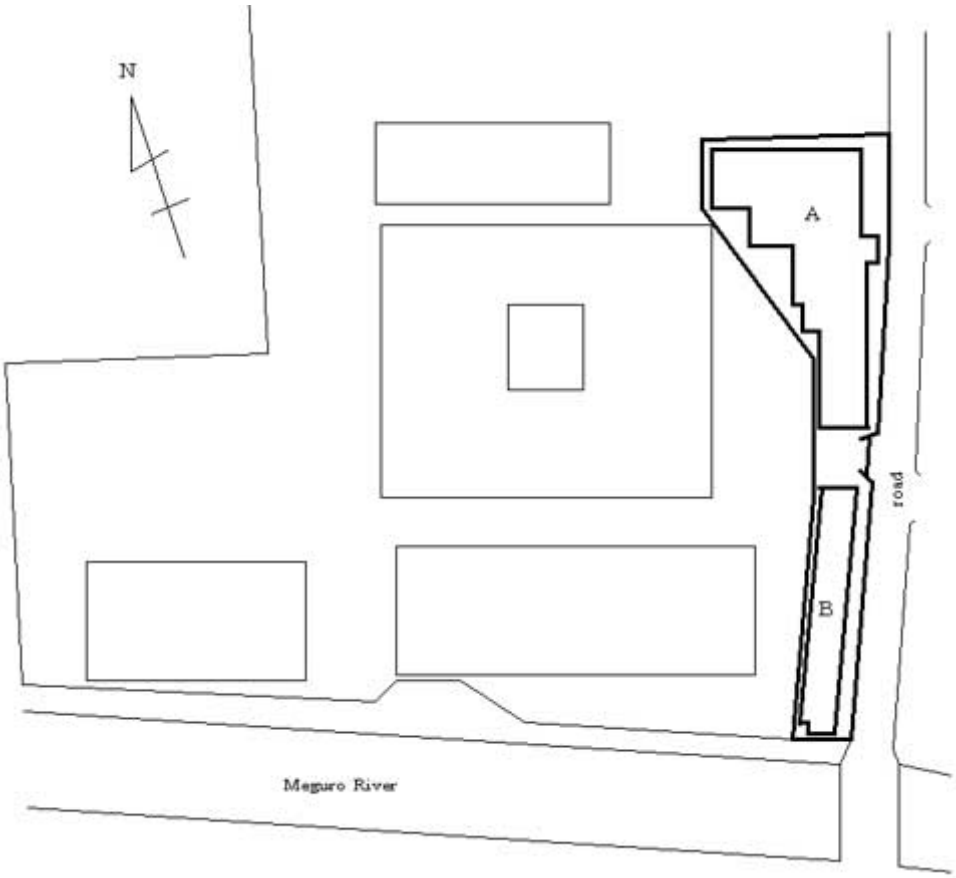
F NMR Laboratory II

G Waste Water Disposal Plant

31-March-2004

Disposition
Meguro Site

Land Area	5,102m^2
Building Area	2,855m^2
Total Floor Space	7,708m^2



A Creep Building

B Materials Database Building

31-March-2004