

# Krishna Gopal Nath, Ph. D.

## ☀️ PARTICULAR INTEREST:

Study of Nanointegrated Systems of Bio-Molecules, Metallic, Semiconductor and Magnetic Nanoparticles

## ☀️ PROFESSIONAL CONTACT ADDRESS:

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## ☀️ CAREER HISTORY:

### Previous (1):

**Position:** COE Fellow at ISSP, University of Tokyo for 2 months

**Laboratory:** Advanced Spectroscopy Laboratory, ISSP, Kashiwa, Tokyo

**Research project:** “Study of the Semiconducting and Magnetic nanostructures”

### Previous (2):

**Position:** JAERI Research Fellow (June 2001 to May 2004)

**Laboratory:** JAERI Synchrotron radiation research center, Tokai-mura, Japan

**Research project:** “Study of the electronics and chemical properties for nano-structural Semiconducting, Carbon and Bio-materials”

### Previous (3):

**Position:** R&D Research fellow (May, 1999- April, 2001)

**Laboratory:** NTT Basic Research Laboratories, Atsugi, Japan

**Research project:** “Study of the ferromagnetic-semiconductor hybrid systems using synchrotron radiation spectroscopy and surface science techniques”

### Previous (4):

**Position:** Ph. D. Researcher (April, 1996- March, 1999)

**Laboratory:** UVSOR, Institute for Molecular Science, Okazaki, Japan

**Research project:** “Spectroscopy and spectromicroscopy study for magnetic thin films and rare earth compounds using synchrotron radiation”.

### Previous (5):

**Position:** M. Sc. Researcher (1993-1995)

**Laboratory:** University of Dhaka, Dhaka, Bangladesh

**Research project:** “Study of laboratory fabricated Si-Schottky diodes”

## ☀️ EXPERIENCE on SEMICONDUCTOR RESEARCH:

- Experiment title:** “Chemical state analysis of nanoscale Si and Ge thin films”.
  - Related publication:** Published in **JAP (2003)** by Krishna G. Nath *et al.*
- Experiment title:** “Chemical interaction of nanoscale Si with oxygen”.
  - Related publication:** Submitted in **Appl. Suf. Sci.** by Krishna G. Nath *et al.*
- Experiment title:** “Laser induced modification of electronic structure of nanoscale Si”.
  - Related publication:** In preparation by Krishna G. Nath *et al.*

## ☀️ EXPERIENCE on BIOMOLECULES and POLYMER RESEARCH:

- Experiment title:** “Investigation of electronic structures for adenosine triphosphate (ATP) thin films by core level x-ray photoemission spectroscopy”.
  - Related publication:** In preparation by Krishna G. Nath *et al.*

2. a. **Experiment title:** “Fragmentation in biological molecules (Amino Acids: L-Cystine, L-Cysteine and L-Methionine) by the irradiation of monochromatized soft X-rays”.
- b. **Related publication:** Submitted in Nucl. Inst. Method A by Y. Baba, T. Sekiguchi, I. Shimoyama and Krishna G. Nath.
3. a. **Experiment title:** “Laser induced reorientation of one dimensional Si-polymer (Poly Dimethylsilane) studied by angle-dependent NEXAFS”.
- b. **Related publication:** To be submitted in **PRB/PRL** by Krishna G. Nath *et al.*

#### ☼ EXPERIENCE on SPINELECTRONICS RESEARCH:

1. a. **Experiment title:** “Study of magnetic thin film on passivated III-V semiconductor”.
- b. **Related publication:** Published in **JAP (2002, 2001), JVST B (2001), and JJAP (2000)** by Krishna G. Nath *et al.*

#### ☼ EXPERIENCE on MAGNETIC THIN FILM RESEARCH:

1. a. **Experiment title:** “Electronic and magnetic structure of Ni, Co films on magnetic and non-magnetic substrate”.
- b. **Related publication:** Published in **PRB (2001), Surf. Sci. (2001), J. Elec. Spec. Rel. Phen. (1999)** by Krishna G. Nath *et al.*

#### ☼ EXPERIMENTAL EXPERTISE:

1. **Deposition techniques:** Electron-irradiated deposition, Molecular beam epitaxy (MBE), Thermal CVD.
2. **Thin film fabrication:** Magnetic, organic, semiconducting and Bio-materials: Fe/Ag, Ni/Cu, Cu/Co/Cu, Co/GaAs, Co/InAs, Si/Graphite, Si/Sapphire, Ge/Graphite, Fe/SiC, Fe/C<sub>60</sub>/Si, Fe/C<sub>60</sub>/SiC, ATP/Graphite, Si-polymer/Graphite.
3. **Substrate preparation:** Sample cleaning methods i.e. micro-polishing, chemical etching, annealing, diamond scraping, ion sputtering, Sample heating: Electron bombardment, LASER annealing.
4. **Electronic structure measurements:** Photoemission spectroscopy and Photoabsorption spectroscopy by VG-ESCA, SCIENTA and CLAM equipped with ultra high vacuum chambers.
5. **Topography measurements:** Microscopy techniques such as Photoemission spectromicroscopy, PEEM, UHV-STM, AFM, SEM.
6. **Magnetic Measurement:** Magnetic linear dichroism (MLD), Magnetic linear dichroism in angular distribution (MLDAD).
7. **Experiment using photon sources:** Synchrotron radiation beamlines, BL2A, BL5B, BL7A at UVSOR facility, Okazaki, Japan; BL1C, BL11A, BL27A at Photon Factory, Tsukuba, Japan; conventional x-ray sources (MgK $\alpha$  and AlK $\alpha$ ), vacuum ultra-violet source.

#### ☼ INSTRUMENTATION:

1. Design and construction of several ultra-high vacuum chambers.
2. Construction of several home-made evaporators for metal, semiconductor and bio-materials deposition.
3. Design and construction of a manipulator combined with He-cryostat, and heating and transfer systems.
4. Establishing the LASER annealing systems for UHV purposes.
5. Establishing the magnetization systems to study the magnetic thin film

#### 12. EDUCATION:

**Ph. D.** in Physics (March 1999), Institute for Molecular Science, Japan

**M. Sc.** in Physics (December 1994), University of Dhaka, Bangladesh

**B. Sc.** in Physics (December 1992), University of Dhaka, Bangladesh

#### 14. PERSONAL INFORMATION:

**Nationality:** Bangladeshi

**Marital Status:** Married (Wife: Soma Debnath)

## COMPLETE LIST OF PUBLICATIONS

### Year 2004

1. **Krishna G. Nath**, I. Shimoyama, T. Sekiguchi and Y. Baba, "Study of the oxidation for Si nanostructures using synchrotron radiation photoemission spectroscopy"; Appl. Surf. Sci. **234**, 234 (2004).
2. **Krishna G. Nath**, I. Shimoyama, T. Sekiguchi and Y. Baba, "Synchrotron radiation photoabsorption and photoemission spectroscopy for thermal-induced reoriented Si polymer", Journal of Electron Spectroscopy and Related Phenomenon (**in press**).
3. **Krishna G. Nath**, I. Shimoyama, T. Sekiguchi and Y. Baba, "Thermally-induced Re-orientation of One-dimensional Si Polymer Studied by Synchrotron Radiation Photoemission and Photoabsorption Spectroscopy", Submitted for the **proceedings of SMAM-1** (Tokyo, March 2004).
4. Md. N. Uddin, I. Shimoyama, Y. Baba, T. Sekiguchi, **Krishna G. Nath** and M. Nagano, "B-C-N hybrid synthesis by high-temperature ion-implantation", Appl. Surf. Sci. (**in press**).
5. Y. Baba, I. Shimoyama, T. Sekiguchi and **Krishna G. Nath**, "Electronic structures of ultra-thin Silicon carbide deposited on graphite"; Appl. Surf. Sci. **234**, 246 (2004).
6. Y. Baba, I. Shimoyama, T. Sekiguchi and **Krishna G. Nath**, "Study of sub-monolayered silicon carbide films"; Appl. Surf. Sci. **237**, 176 (2004).
7. T. Sekiguchi, Y. Baba, I. Shimoyama and **Krishna G. Nath**, "Fragmentation pathways caused by soft X-ray irradiation: The detection of desorption products using a ratable time-of-flight mass-spectrometer combined with pulsed synchrotron radiation"; Nucl. Inst. Method A (**in press**).
8. T. Sekiguchi, Y. Baba, I. Shimoyama and **Krishna G. Nath**, "Orientation nature of fluorinated graphite surface studied by X-ray photoelectron spectroscopy, polarization dependent electron- and ion-NEXAFS spectroscopy"; Appl. Surf. Sci. (**in press**).

### Year 2003

9. **Krishna G. Nath**, I. Shimoyama, T. Sekiguchi and Y. Baba, "Chemical-state analysis for low-dimensional Si and Ge films on graphite"; J. Appl. Phys. **94**, 4583 (2003). (*Selected by editors for publication in September 29, 2003 issue of the Virtual Journal of Nanoscale Science & Technology (<http://www.vjnano.org>).*)
10. **Krishna G. Nath** and co-workers, "Photoemission Study of Mixed-Valent Tm-monochalcogenides: Evidence of Electron-Correlation Effect in Different Tm-Core Levels", J. Phys. Soc. Jpn. **72**, 1792 (2003).
11. I. Shimoyama, Y. Baba, S. Tetsuhiro, **Krishna G. Nath**, "Characterization of B-C-N hybrid prepared by ion implantation"; Journal of Vacuum Science and Technology **A21**, 1843 (2003).
12. K. Prabhakaran, Y. Watanabe, **Krishna G. Nath**, Y. Homma, T. Ogino, K. V. P. M. Shafi, and A. Ulman, "Surface chemistry of Fe<sub>2</sub>O<sub>3</sub> nanoparticles on ultrathin oxide layers on Si and Ge". Surf. Sci. **545**, 191 (2003).

## Year 2002

13. **Krishna G. Nath**, F. Maeda, S. Suzuki, and Y. Watanabe, "Passivation-mediated growth of Co on Se, S and O rich GaAs surfaces: A potential approach to control interface crystallinity and magnetic continuity", J. App. Phys. (communication) **91**, 3943 (2002).
14. T. Kinoshita, H. Gunasekara, Y. Takata, S. Kimura, M. Okuno, Y. Haruyama, N. Kosugi, **Krishna G. Nath**, H. Wada, A. Mitsuda, M. Shiga, T. Okuda, A. Harasawa, H. Ogasawara, A. Kotani, "Spectroscopy study of temperature-induced valance transition on  $\text{EuNi}_2(\text{Si}_{1-x}\text{Ge}_x)_2$  around 3d-4f, 4d-4f and Ni 2p-3d excitation regions", J. Phys. Soc. Jp. **71**, 148 (2002).

## Year 2001

15. **Krishna G. Nath** Y. Haruyama and T. Kinoshita; "Observation of Satellite in Co2p Photoemission Spectra: Evidence of Localized Electronic Structure in Thin Film", Physical Review **B 64**, 245417-1 (2001).
16. **Krishna G. Nath**, F. Maeda, S. Suzuki, and Y. Watanabe, "Modified epitaxy in Co/S/GaAs(001) and comparison with Co/GaAs(001)", J. App. Phys. **90**, 1222 (2001). (*Selected by editors for publication in September 17, 2001 issue of the Nanojournal (<http://www.nanojournal.org>).*)
17. **Krishna G. Nath**, F. Maeda, S. Suzuki, Y. Watanabe; "Surfactant-Mediated Control of Surface Morphology For Co Epitaxial Film on S-passivated Semiconducting Substrate", Journal of Vacuum Science and Technology **B 19**, 384 (2001).
18. **Krishna G. Nath** Y. Haruyama, T. Kinoshita; "Surface reconstruction and magnetic stability of Co thin film on O<sub>2</sub>-rich Cu(001) surface", Surf. Sci. **486**, 185 (2001).
19. S. Suzuki, Y. Watanabe, T. Kiyokura, **Krishna G. Nath** and co-workers, "Electronic structures of carbon nanotube tips studied by photoemission spectroscopy", Physical Review **B 63**, 245418 (2001).
20. S. Suzuki, T. Kiyokura, F. Maeda, **Krishna G. Nath** and co-workers, "Observation of Ga3d two-hole states from GaAs surfaces, J. Electron Spectrosc. Relat. Phenom. **114-116**, 421 (2001).
21. Suzuki, C. Bower, T. Kiyokura, **Krishna G. Nath** and co-workers, "Photoemission spectroscopy of singles-walled carbon nanotube bundles" J. Electron Spectrosc. Relat. Phenom. **114-116**, 225(2001).

## Year 2000

22. **Krishna G. Nath**, F. Maeda, S. Suzuki, Y. Watanabe; "Epitaxy, modification of electronic structures, overlayer-substrate reaction and segregation in ferromagnetic Co films on Se-treated GaAs(001) surface", Jpn. J. Appl. Phys. **39**, 4571 (2000).
23. S. Suzuki, T. Kiyokura, F. Maeda, **Krishna G. Nath**, Y. Watanabe, T. Saito, A. Kakizaki; "Resonant photoemission spectroscopy of Ga3d two-hole states of GaAs, J. Jpn. Phys. Soc. **69**, 1807 (2000).

## Year 1999

24. **Krishna G. Nath**, Y. Haruyama, S. Kimura, Y. Ufuktepe, T. Kinoshita; "Study of Magnetic Linear Dichroism (MLD) for different thickness of Ni-film grown on

- ferromagnetic Co(001) in element specific photoemission”, J. Electron Spectrosc. Relat. Phenom. **101-103**, 257 (1999).
25. Y. Haruyama, **Krishna G. Nath**, S. Kimura, Y. Ufuktepe, T. Kinoshita, K. Hiraki, K. Kanoda; “Electronic structures of organic salts (DI-DCNQI)<sub>2</sub>M (M= Ag and Cu) using photoelectron spectromicroscopy”, Solid State Commun. **110**, 17 (1999).
  26. S. Kimura, **Krishna G. Nath**, Y. Haruyama, T. Kinoshita, S. Yoshii. M. Kasaya; “Anisotropic optical conductivity of RPtAs (R= La, Ce)”, Physica **B 259-261**, 1163, (1999).
  27. T. Kinoshita, **Krishna G. Nath**, Y. Haruyama, M. Watanabe, S. Yagi, S. Kimura and A. Fanelas; “Photoelectron Spectromicroscopy experiments at the UVSOR facility” J. Electron Spectrosc. Relat. Phenom. **92**, 165 (1999).

### **Year 1998**

28. **Krishna G. Nath**, Y. Ufuktepe, S. Kimura, T. Kinoshita, H. Kumigashira, T. Takahashi, T. Matsumura, T. Suzuki, H. Ogasawara and A. Kotani; “4d core level resonant photoemission spectroscopy of Tm Monochalcogenides around Tm3d threshold.” J. Electron Spectrosc. Relat. Phenom. **88-91**, 369 (1998).
29. T. Kinoshita, Y. Ufuktepe, **Krishna G. Nath**, S. Kimura, H. Kumigashira, T. Takahashi, T. Matsumura, T. Suzuki, H. Ogasawara and A. Kotani; “Resonant photoemission studies of Thulium Monochalcogenides around Tm3d threshold.” J. Electron Spectrosc. Relat. Phenom. **88-91**, 377 (1998).
30. Y. Ufuktepe, S. Kimura, T. Kinoshita, **Krishna G. Nath**, H. Kumigashira, T. Takahashi, T. Matsumura, T. Suzuki, H. Ogasawara and A. Kotani; “Resonant photoemission studies of Thulium Monochalcogenides around the Tm4d threshold” J. Phys. Soc. Jpn. **67**, 2018 (1998).
31. S. Kimura, Y. Ufuktepe, **Krishna G. Nath**, T. Kinoshita, H. Kumigashira, T. Takahashi, T. Matsumura, T. Suzuki, H. Ogasawara and A. Kotani; “4d-4f and 3d-4f resonant photoemission of TmX (X= S, Se and Te)”, JMMM **177-181**, 349 (1998).