Direct Observation of N-(Group V) Bonding Defects in Dilute Nitride Semiconductors Using Hard X-ray Photoelectron Spectroscopy

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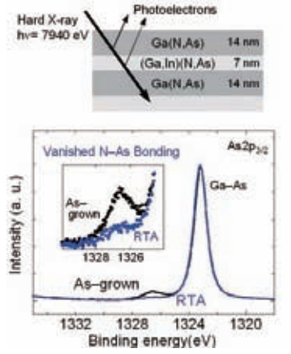
***Applied Physics Letters*, 98,** 12915-1-3 (2011)

Using bulk sensitive hard x-ray photoelectron spectroscopy, we directly observe a spectrum related to N–As bonding defects in (Ga,In)(N,As)/Ga(N,As) heterostructure. The defects are most likely attributed to split interstitials. Their concentration is in the order of 0.1%, close to the detection limit of the measurement. Rapid thermal annealing eliminates the defects, leading to those undetectable. Similar phenomenon is observed for N–P bonding defects in In(N,P). The results indicate common features in dilute nitride semiconductor system: existence of N-(group V) bonding defects and their behavior on postgrowth annealing.



Effect of Temperature on Fast Hydrogen Diffusion in Iron: A Path-Integral Quantum Dynamics Approach

Kimizuka, H.; ***Mori, H.***; ***Ogata, S.***
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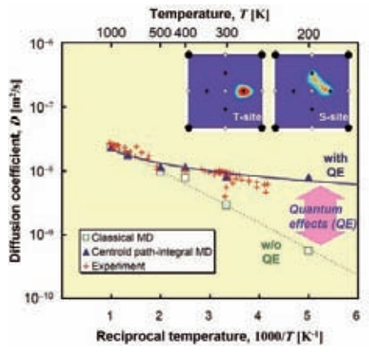
***Physical Review B,* 83,** 094110 (2011)

We explicitly present the diffusion coefficients (D) and activation energies (Ea) of interstitial H in α-Fe over a temperature range of 100 to 1000 K. These values were predicted by applying path-integral molecular dynamics modeling based on first principles. The obtained D and Ea values exhibit clear non-Arrhenius temperature dependence and a transition from quantum to classical behavior at around 500 K. Our results show that the quantum effects not only significantly lower the diffusion barrier but also change the diffusion pathway even at room temperature; thus, fast diffusion becomes possible.



Adaptive Virtual Network Topology Control Based on Attractor Selection

Koizumi, Y.; Miyamura, T.; ***Arakawa, S.***; Oki, E.; Shiomoto, K.; ***Murata, M.***
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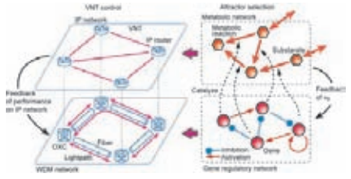
***Journal of Lightwave Technology,* 28,** 1720-1731 (2010)

This paper proposes an adaptive Virtual Network Topology (VNT) control method, which reconfigures VNTs according to traffic conditions on VNTs, in IP over wavelength-routed WDM networks. To achieve adaptability in the VNT control method, we focus on attractor selection, which models behaviors where biological systems adapt to environmental changes. Our proposal uses deterministic and stochastic behaviors and controls these two by simple feedback of the conditions of an IP network. By utilizing stochastic behavior, our approach adapts to various changes in traffic demand with selecting suitable VNTs. The simulation results indicate that our proposal adapts to at most twice larger changes in traffic demand than existing heuristic approaches.



Highly Phosphorescent Crystals of Vaulted *trans*-Bis(salicylaldiminato) platinum(II) Complexes

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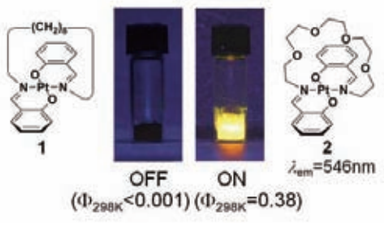
***Journal of the American Chemical Society,* 133,** 6493-6496 (2011)

Unprecedented strong phosphorescent emission in the crystalline state is observed for a variety of vaulted *trans*-bis(salicylaldiminato)platinum(II) complexes which are newly synthesized as a third coordination mode of well-studied bis(salicylaldiminato) complexes. The crystalline emission of the complexes can be controlled by selection of the type and length of the linkers. Crystals of vaulted complexes bearing dodeca- and trideca-methylene linkers exhibit high quantum yields, while related analogues with shorter linkers are nonemissive. A PEG-bridged crystal **2**, which exhibits the highest quantum yield at ambient temperature, stabilizes its beneficial molecular array by an intermolecular H-bonding network through neighboring PEG units.



Nanotube Formation through the Continuous One-Dimensional Fusion of Hollow Nanocapsules Composed of Layer-by-Layer Poly(lactic acid) Stereocomplex Films

Kondo, K.; ***Kida, T.***; ***Ogawa, Y.***; ***Arikawa, Y.***; ***Akashi, M.***
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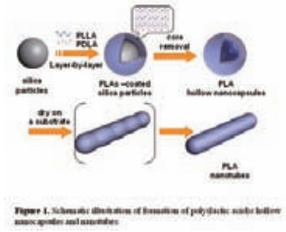
***Journal of the American Chemical Society,* 132,** 8236-8237(2010)

Nanotubes have attracted much attention as potential nanocontainers, nanoreactors, and drug carriers. However, the facile fabrication of organic nanotubes with controllable film thickness and diameters has remained a challenging subject. We succeeded in fabricating the hollow nanocapules of poly(lactic acid)s (PLAs) stereocomplex films by a combination of the layer-by-layer assembly technique and the silica template method, and found that these nanocapsules one-dimensionally fused together to generate novel PLA nanotubes. The formation of these nanotubes was affected by the molecular weights of the PLAs comprising the hollow capsules. We believe that this nanotube formation may provide a new strategy for creating nanotubes with a defined diameter and film thickness.



Self-organization of a Stable Pore Structure in a Phospholipid Bilayer

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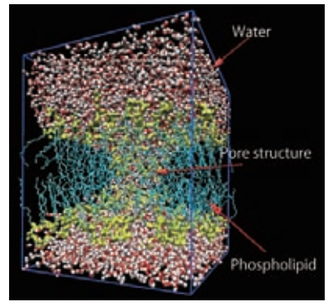
***Physical Review Letters,* 105(1),** 018105 (2010)

A stable water-filled pore penetrating the biological cell membrane plays an essential role in drug delivery processes across the membrane and has so far been considered to be generated by external forces. Our unsteady and nonequilibrium molecular dynamics simulations have revealed that the stable pore can be formed spontaneously without any external forces when a phospholipid bilayer (the fundamental structure of the membrane) is loaded with a certain amount of water molecules. The bilayer loaded with water molecules represents the membrane stimulated by ultrasound radiation, and hence our finding rationalizes the membrane permeabilization during sonoporation (ultrasound-mediated drug delivery technique).

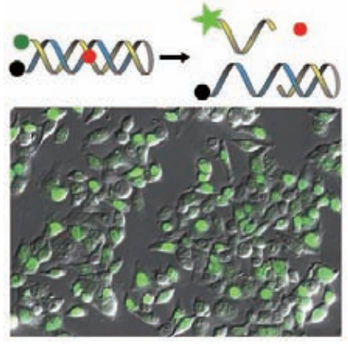


Fluorescent Probes for the Analysis of DNA Strand Scission in Base Excision Repair

Matsumoto, N.; ***Toga, T.***; ***Hayashi, R.***; Sugasawa, K.; Katayanagi, K.; Ide, H.; ***Kuraoka, I.***; ***Iwai, S.***
(Graduate School of Engineering Science)

***Nucleic Acids Research*, 38,** e101 (2010)

We have developed fluorescent probes for the detection of strand scission in the excision repair of oxidatively damaged DNA. They were hairpin-shaped oligonucleotides containing a damaged base in the center, with a fluorophore and a quencher at the 5'- and 3'-ends, respectively. Fluorescence was detected when the phosphodiester linkage at the damage site was cleaved by the base excision repair enzyme. The substrate specificities of *Escherichia coli* endonuclease III and its human homolog, NTH1, could be determined in *in vitro* experiments, and the base excision repair activity was successfully detected in HeLa cells with a phosphorothioate-modified probe containing thymine glycol.



Effect of Antiferromagnetic RKKY Interaction and Magnetic Field in a Two-impurity Kondo System

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***Physical Review B,* 82,** 153203 (2010)

The interference between the Kondo effect and the RKKY interaction is the fundamental problem in the strongly correlated electrons. To uncover deeper aspect of this interference, we explore the magnetic field dependence of the single-particle excitation spectra (SPES) of a magnetic dimer on a conducting surface using the numerical renormalization-group technique. When the antiferromagnetic Ruderman-Kittel-Kasuya-Yoshida (RKKY) interaction is dominant, a dip structure is observed near the Fermi level in the SPES. However, upon application of a certain external magnetic field, a peak structure appears near the Fermi level. We propose that the antiferromagnetic RKKY interaction can be measured through this magnetic field dependence of the SPES.