

Verein  
Koreanischer  
Naturwissenschaftler und  
Ingenieur in der BRD e.V.



**In commemoration of ASCoF 30<sup>th</sup> anniversary  
and 120<sup>th</sup> year of Korea- France diplomatic relations**

## **The 2<sup>nd</sup> Conference of Korean Scientists & Engineers in Europe**

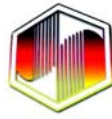
**Saturday, 4 November 2006  
Paris Novotel Tour Eiffel  
61, Quai de Grenelle, 75015 Paris**

Organised by :

**ASCoF, KSEAUK & VeKNI**

*ASCoF: Association des Scientifiques Coréens en France, 재불과학기술자협회*  
*KSEAUK: The Korean Scientists and Engineers Association in the UK, 재영과학기술자협회*  
*VeKNI: Verein Koreanischer Naturwissenschaftlicher und Ingenieure in der BRD e.V.*  
*재독과학기술자협회*





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Koreanischer  
Naturwissenschaftler und  
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# The 2<sup>nd</sup> Conference of Korean Scientists & Engineers in Europe

Saturday, 4 November 2006  
Paris Novotel Tour Eiffel  
61, Quai de Grenelle, 75015 Paris

## 1. Introduction

The *Association des Scientifiques Coréens en France (ASCoF, Korean Scientists and Engineers Association in France)* organises the 2<sup>nd</sup> Conference of Korean Scientists and Engineers in Europe jointly with the KSEAUK (Korean Scientists and Engineers in UK) and the VeKNI (Korean Scientists and Engineers in Germany) following to the 1<sup>st</sup> conference held in London in 2004. This conference is also held to remember the 30<sup>th</sup> anniversary of the ASCoF.

## 2. Conference organisation

### Chair:

Prof. Woo-Suck HAN, *Ecole Nationale Supérieure des Mines de Saint-Étienne, ASCoF*

### Organizing Committee

Dr. Wonsun PARK, *Leibniz Institute of Marine Sciences, VeKNI*

Mr. Yoonjae LEE, *Queen Mary, University of London, KSEAUK*

Dr. Joung Hwan LEE, *University of Sheffield, KSEAUK*

Dr. Hae-Yeong LEE, *Microsystems, ASCoF*

### 3. Program

<b>09:00</b>	Opening Ceremony - Opening speech: Prof. Woo-Suck HAN, Chair - Welcome speech: Prof. Young-Hyang Park, President of ASCoF - Congratulatory speeches: President of KOFST, President of VeKNI, President of KSEAUK, etc... - Declaration of the presidents of ASCoF, KSEAUK & VeKNI		
<b>09:50</b>	Presentation of industrial partners		
<b>10:30</b>	Coffee Break		
<b>10:50</b>	Plenary Session		
<b>12:00.</b>	Lunch		
<b>14:00</b>	Session 1 Physics, Environment, Biology & Medicine	Session 2 Computer sciences, Electronics, IT	Session 3 Mechanical Engineering, Materials
<b>16:05</b>	Round Table by Session & Coffee Break		
<b>16:30</b>	Cloture		

### Plenary Session

*Chair : Prof. Woo-Suck HAN (Ecole Nationale Supérieure des Mines de Saint-Étienne, ASCoF)*

**10:50**    **The present status of elementary particle physics, Prof. Bjong Ro KIM, RWTH Aachen University, VeKNI**

**11:25**    **Neuromorphic device/neural networks VLSI – an electronic implementation of bio-inspired intelligence or biologically plausible system, Dr. Il-Song HAN, University of Sheffield, KSEAUK**

### Session 1 : Physics, Environment, Biology & Medicine

*Chairs : Prof. Sun-Sik MIHN (University of Nantes, ASCoF),  
Prof. Bjong Ro KIM, (RWTH Aachen University, VeKNI)*

**14:00**    **X-Ray Free Electron Lasers, Dr. Jang-Hui HAN, Deutsches Elektronen-Synchrotron, VeKNI**

**14:20**    **Modelisation and data assimilation in physical oceanography, Dr. Michel Gavart, Observatoire Midi-Pyrénées, ASCoF**

**14:40**    **Role of trees as indicator for environmental changes, Jeong-Wook SEO, University of Hamburg, VeKNI**

**15:00**    **Water, Water, Water, Dr. Sung Taek OH, University of Manchester, KSEAUK**

**15:20**    **Flexibility for Individual Needs, Dr. Seo-Rin KO, Altona General Hospital Hamburg, VeKNI**

**15:40**    **Protein Conformation-Dependent Neurodegenerative Diseases: Underlying Molecular-Level Commonalities (“Mad Cows, Mad People, and the Mad Dash Towards Developing New Treatments”), Dr. Hun MOK, Trinity College Dublin, KSEAUK**

## **Session 2 : Computer sciences, Electronics, Information Technology**

*Chairs : Dr. Hae-Yeong LEE (Microsystems, ASCoF),  
Dr. Il-Song HAN (University of Sheffield, KSEAUK)*

- 14:00 Association Discovery Protocol for Hybrid Wireless Mesh Networks, Song Yeon CHO, Ecole Polytechnique and INRIA, ASCoF**
- 14:20 Integrated Information System Supporting Energy Action Planning via the Internet, Dr. Jae-Min KIM, University of Strathclyde, KSEAUK**
- 14:40 Image Navigation and Registration System for GEO Observation Satellite, Dr. Gwanghyeok JU, Korea Aerospace Research Institute, ASCoF**
- 15:00 Bioinformatics... Past and Future, Hosil PARK, University of Manchester, KSEAUK**
- 15:20 Study on COMS AOCS Manoeuver Realization, Dr. Han-dol KIM, Korea Aerospace Research Institute, ASCoF**

## **Session 3 : Mechanical Engineering, Materials**

*Chairs : Dr. Yongmann M CHUNG (University of Warwick, KSEAUK)  
Dr. Wonsun PARK, (Leibniz Institute of Marine Sciences, VeKNI)*

- 14:00 Numerical Simulations of Unsteady Turbulent Flows, Dr. Yongmann M. CHUNG, University of Warwick, KSEAUK**
- 14:20 Heat Transfer Analysis in Composite Tape Lay-Up Process, Prof. Chung Hae PARK, University of Le Havre, ASCoF**
- 14:40 Ceramic Micro Combustion Engine Design and Fabrication, Dr. Jung-Sik KIM, University of Birmingham, KSEAUK**
- 15:00 Indirect Search for Dark Matter with AMS-02 Detector on the International Space Station, Chang Hoon CHUNG, RWTH-Aachen, VeKNI**
- 15:20 Columnar To Equiaxed Transition during Directional Solidification Processing in Aluminium Alloys, Hyejin JUNG, Université Paul Cézanne Aix-Marseille III, ASCoF**
- 15:40 Comparison of High Temperature Corrosion Behaviour of Superheater Materials and Reactivity of Biomass Ashes in Biomass Combustion, Dr. Sung Chul CHA, Siemens Power Generation, VeKNI**



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## PLENARY SESSION

Chair : Prof. Woo-Suck HAN (Ecole Nationale Supérieure des Mines de Saint-Étienne, ASCoF)

## RESUME

김병로 박사

1960--1966 : University Muenchen ,Germany  
1966 Diplom (MS) in physics  
1966-1969 : University Muenchen and Max-Planck-Institut fuer Physik in Muenchen  
1969 PhD in Elementary Particle Physics  
1969--1971 ; Post doc ,Max-Planck-Institut  
1971--2000 : RWTH-University Aachen  
2000: retirement  
2000--present; continuation of research in particle physics, Uni. Aachen

Invited Professor;

Korea Advanced Institute of Science and Technology

1983 summer semester

1985 summer semester

1987 summer semester

KyungPuk National University, Center for High Energy Physics ,Daegu Korea

September 2003--April 2004

# The present status of elementary particle physics

Bjong Ro Kim

*RWTH Aachen University  
Aachen, Germany  
kim@physik.rwth-aachen.de*

## ABSTRACT

The ultimate goal of particle physics is to investigate what are the fundamental constituents and forces of our universe. This talk is an overview of our present understanding of this subject for non-specialists.

It is done in the framework of the Standard Model (SM), the most successful theory of particle physics. I discuss first the achievements of SM, then the reasons why SM can not be the final theory and has to be extended. An attractive candidate for the extension is the Supersymmetry(SUSY). I briefly discuss some characteristic features of SUSY-Models.

**KEYWORDS:** particle physics

## RESUME

한 일송 (韓 一松)

### □ 학력사항

- 1979 : 서울대학교 공대 전자공학과 졸업
- 1981 : 한국과학기술원 (KAIST) 전기 및 전자공학과 석사 학위
- 1984 : 한국과학기술원 (KAIST) 전기 및 전자공학과 박사 학위
- 2000 : 영국 Cranfield University, School of Management MBA

### □ 경력사항

- 1984 ~ 1985 : 한국과학기술원 Post-Doc 연구원
- 1985 ~ 1998 : 한국통신 연구개발원 책임연구원
  - 신경망 컴퓨터, ISDN, CT-2 등 정보통신 신기술 연구개발 프로젝트 수행
  - 신경망 칩 기술 개발
    - \* 'Fuzzy Logic and Neural Network Handbook' (1996 McCraw-Hill 출판사): 세계의 새로운 신경망 칩 기술로 수록
    - \* British Telecom (영국 통신)과 지능형 실시간 패킷 스위치 제어기 공동개발 추진(1996-1997) : Financial Times(1998.1.14), BT-KT 공동 개발한 신경망 칩 기사화
- 2000: 영국 Imperial College London Research Fellow
- 2001 ~ 2002 : 영국 벤처기업 Jennic Ltd, Senior Engineer
- 2002 ~ 현재 : 영국 University of Sheffield, Electronic and Electrical Eng, Lecturer

# **Neuromorphic device/neural networks VLSI – an electronic implementation of bio-inspired intelligence or biologically plausible system.**

I. S. Han

*Dept of Electronic and Electrical Engineering  
University of Sheffield, Sheffield, U.K.*

[i.s.han@sheffield.ac.uk](mailto:i.s.han@sheffield.ac.uk)

## **ABSTRACT**

There has been significant research in biologically plausible systems, but biologically inspired intelligence or information processing is still a difficult problem in realising machines with a *human touch* – intelligence. In particular, under limited real-time operations of biologically plausible modelling by computing resources, insect-inspired artificial eyes as well as artificial retinas of the vertebrate eye have been investigated to develop a broad range of applications.

By mimicking a biological system's intelligence or to emulate its natural function, biologically-inspired spike-based neural networks are being investigated widely in various areas, from robots to regenerative medicine. The pulse or spike based implementation of a neural network has advantages for neuromorphic solutions, which are suitable for large-scale, real-time or embedded applications.

A mixed-signal VLSI implementation is proposed for low power and asynchronous neural networks or neuromorphic operation. The voltage-controlled transconductance produces the synaptic function of multiplication and summation of synaptic currents for neuron, by compensating the non-linearity of MOSFET resistance in the triode region. The flexible configuration of synapse accommodates the spike-based neural networks, inspired by the biological plausibility and low power requirement. The neuron with a combination of synapses demonstrates asynchronous spikes of integration-and-firing with a refractory period. The speed of individual synapse is simulated up to 300 Mega operations/sec with the power consumption of less than 33 $\mu$ W, using 0.18 $\mu$ m CMOS.

This new research aims to enable biologically plausible intelligence or computation for electronic systems, and provide a practical implementation in VLSI processors. The application of transconductance based analogue-mixed circuit is investigated for implementing large scale neural networks of spike-based asynchronous operation, the biologically inspired Hodgkin-Huxley like neuron, and primitive vision processing.

**KEYWORDS:** *Pulse/spike based neural network, Neuromorphic device, VLSI, Analogue-mixed circuit*

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# SESSION 1

## Physics, Environment, Biology & Medicine

### Chairs

Prof. Sun-Sik MIHN (University of Nantes, ASCoF),  
&  
Prof. Bjong Ro KIM, (RWTH Aachen University, VeKNI)

## RESUME

### 한장희 (Jang Hui Han, 전문강연 1)

#### 학력:

1995 Korea University, Geology (major) and Physics (minor), Bachelor

1997 Pohang University of Science and Technology, Accelerator Physics, Master

2005 Hamburg University, Accelerator Physics, Doctor

#### 경력

1997 - 2002 Pohang Accelerator Laboratory 근무

2002 - 현재 Deutsches Elektronen-Synchrotron DESY 근무

## **X-Ray Free Electron Lasers**

Jang-Hui Han

*Deutsches Elektronen-Synchrotron, DESY  
Notkestrasse 85, 22607 Hamburg, Germany  
jang.hui.han@desy.de*

### **ABSTRACT**

X-ray free electron lasers based on linear accelerators make entirely new experiments possible. Ultra fast phenomena can be monitored with the femto-second pulse length laser and the coherence of the laser allows resolving nanometer scale images. At DESY Hamburg, a short wavelength free electron laser with a wavelength of 13 nm is operating as a user facility. A shorter wavelength free electron laser down to the X-ray regime is under construction with an international collaboration. The principle of accelerator based free electron lasers and their applications are discussed.

**KEYWORDS:** Accelerator, Free Electron Laser

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## **RESUME**

### **Michel Gavart**

Director of MGC

Ph.D., at ENSTA/ Uuiv. Paul Sabatier

# Modelisation and data assimilation in physical oceanography

Michel Gavart

*SHOM / RE*  
*Observatoire Midi-Pyrénées*  
*14, avenue Edouard Belin*  
*31400 TOULOUSE*  
*gavart-consultant@wanadoo.fr*

**KEYWORDS:** Oceanography, Numerical models, Data assimilation.

## ABSTRACT

Ocean modelling is an essential tool in oceanography for a better understanding of the physics of oceans. Indeed, they are involved in a wide panel of applications, like in climate studies as well as in high resolution regional scale or coastal studies.

The resolution of the models (mesh size) determines the phenomena to simulate : coarse grids (~25km) permit only to simulate the basin-scale circulation (climate) whereas smaller grid sizes (8km) simulate small-scale eddies and very high resolution models (<1km resolution) are mainly used in coastal or littoral applications. The non-simulated sub-mesh physics (diffusion processes) is parameterised by diffusion terms in the equations of the model. The computational and data storage cost usually leads to adapt the modelling area (global, basin scale, regional or coastal) to the mesh size : that's why models for climate studies which involve the global ocean have a relatively coarse grid, and coastal models have a restricted area and a boundary connected to the open ocean.

Ocean models are based on fluid mechanics equations (the so called Navier-Stokes equations) approximated to the specificity of geophysical fluid flow : large scale quasi-horizontal flow. Indeed, the state of the ocean is supposed (in most of the models) to be hydrostatic and only forced dynamically by surface winds, density modification, bottom friction and Coriolis effects (earth rotation). The thermodynamics is based on surface heat and salt exchanges, internal diffusion of temperature and salinity, and an equation of state connects density, temperature, salinity and pressure. The biggest concern in ocean modelisation is to provide a realistic initial state for models : it is not possible to precisely measure the complete ocean state at a given time. Also, during computing, the models has its proper errors (equations are not always perfectly fitted to the real ocean physics) which grow with time. And finally, the atmospheric forcing, issued from meteorological models, also contains some errors. That's why we constantly need to correct the *model trajectory* with the available measurements, like in meteorology. Special techniques are used for this and they are called **data assimilation** : the model has to be similar to the observations. Two main kinds of observations do exist : remote sensed, and in situ.

**Remote sensed observations** are mainly provided by **satellites**. The main advantage is to get a global covering in a relatively short time; the measurements are radar (altimetry) or

radiometry (infrared or ocean color). The main disadvantage of remote sensed observations is that they are confined to the surface of the ocean : one has to extrapolate by special techniques the given surface information.

**In situ measurements** are the most accurate, and usually give a three dimensional view of the ocean. The usually measured variables are temperature, salinity and currents. The main disadvantage of in situ measurements is that they are sparse in space and time, expensive and sometimes long to be treated and be available to the models. Many different techniques can be deployed to perform in situ measurements : fixed buoys and currentmeters, drifting floats, measurements from boats, autonomous diving floats, gliders, ... .

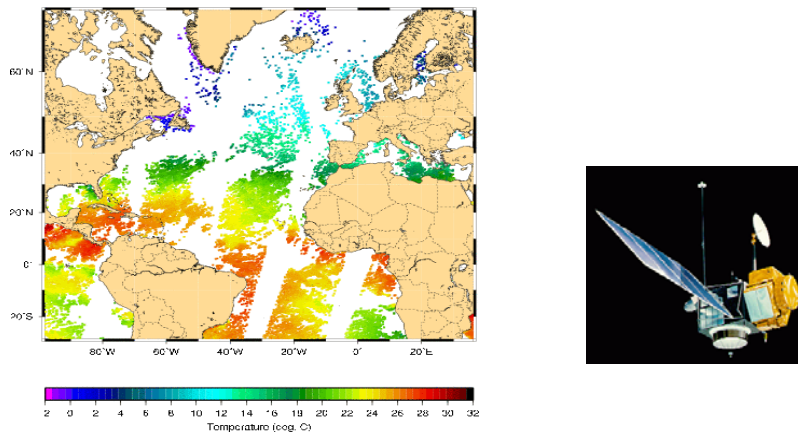


Fig. 3 : surface temperature of the ocean provided by satellite (photo : CNES)



Photos are from CNRS, SHOM, ARGO-Japan

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## RESUME

### 서정욱 (Jeong-Wook Seo, 전문강연 1)

#### 학력

학사: 충북대학교 임학과

석사: 상동

박사: 함부르크대학교 목재생물연구소

세부전공: 나이테 및 형성층분석 (연륜연대)

#### 경력 (참여한 프로젝트)

나이테를 이용한 지구온난화 조사 (농림부)

나이테를 이용한 문순시그널 조사 (한국과학재단)

GIS기법을 이용한 나이테 변동의 시-공간적 분석 (한국과학재단)

온난화에 따른 수목한계선의 생태계변화 조사 (EU project)

#### 업적

국내논문 8편

국제논문 3편

## **Role of trees as indicator for environmental changes**

Jeong-Wook Seo

*Division of Wood Biology, Dept. of Wood Science, University of Hamburg  
Leuschnerstr. 91, D-21031, Hamburg, Germany  
j.seo@holz.uni-hamburg.de*

### **ABSTRACT**

The tree-ring features, such as total tree-ring width, early- and latewood width, maximum wood density, are determined by the cambium producing all woody tissues in a tree. The cambium is responsible for the quantitative and qualitative growth of trees and the onset, intensity and end of the cambial activity during a growing season are triggered by environmental factors, such as temperature and precipitation or soil conditions, but they are also influenced, e.g. by air pollution or human activities. Because of this basic phenomenon, tree-ring data have been used as a proxy or an indicator for previous climate conditions, geomorphological events (e.g. landslides, avalanches), forest disturbances (e.g. forest fires, insect damages), and air pollution (e.g. increasing CO<sub>2</sub> or sulphur dioxide in the ambient air). Moreover, tree-ring data are applied for dating archaeological, architectural and art-historical timbers (e.g. altars, furniture, music instruments, sculptures). All these information from trees are obtained in calendar years.

In order to enhance the time resolution from a yearly basis to a monthly or even weekly basis, the pinning technique was designed. It makes a wound in the cambium by putting a pin through the bark and cambium into the wood. Due to this action, the cambium close to the pinning canal stops to form new wood cells immediately. The amount of wood formation until a pinning date is, therefore, precisely recorded inside the tree. We applied this method to Scots pine trees (*Pinus sylvestris* L.) in Finnish Lapland from 2000 to 2004 at two sites 200 km apart from each other. Some results as regards the climatic influences on tree growth at the northern tree line will be presented.

**KEYWORDS:** *Pine, tree rings, cambium, pinning climate signal*

## RESUME

### 오성택

Research Associate  
Manchester University  
(EPSRC Advanced Research fellowship) : Environmental  
Engineering/University of Glasgow

(2006, Research Associate) : Environmental Engineering/University of  
Manchester

(2005, Ph.D.) : Environmental Engineering/University of Manchester

(2001, M.Sc.) : Environmental Engineering/Queen's University of Belfast

(1997, B.Sc.) : Environmental Engineering/Seoul National University

Sung. T. Oh  
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# Water, Water, Water

Sung Taek Oh

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Sungtaek25@hotmail.com*

## ABSTRACT

Water (H<sub>2</sub>O) is a truly remarkable chemical compound, fundamental to life on Earth. Earth is the only planet in the Solar System where the present surface temperature and pressure allow the three forms of water, solid (ice), liquid (ocean), and gas (water vapor condensing in clouds) to exist simultaneously.

However the water was contaminated. Water pollution affected oceans and inland bodies of water. Examples include organic and inorganic chemicals, heavy metals, petrochemicals, chloroform, and bacteria. Water pollution may also occur in the form of thermal pollution and the depletion of dissolved oxygen.

Drinking water conservation and wastewater treatment (the water technologies) were required. But, as developing the water technologies, the by-product (sewage sludge) of the treatment was increased. For example, over the last decade some 1 million tonnes as dry solid was produced annually in the UK, this rose to approximately 1.6 million tonnes in 2005 from 1998, and this is expected to rise to 1.8 million tonnes by 2010 as a greater proportion of sewage is treated and higher treatment standards are applied under the phased implementation of the Urban Waste Water Treatment Directive [91/271/EEC].

In this conference, we will discuss the trend of water pollution, the importance of water assets, and the prospective of water treatment in EU. For the new trend for the technology of sewage treatment (energy production), further, the energy production (electricity) may be also introduced in this conference for Korean scientists and engineers in Europe.

**KEYWORDS:** water

## RESUME

고서린 (Seo-Rin Ko, 전문강연 1)

### **Education:**

1997 to 2003 University Hospital Hamburg-Eppendorf, Hamburg, Germany  
2003 Trauma/General Surgical Services at San Francisco General Hospital,  
University of California San Francisco

### **Residency Training:**

2004-2006 Department of General Surgery, Altona General Hospital Hamburg  
since 2006 Department of Thoracic and Vascular Surgery, Altona General Hospital Hamburg

## Flexibility for Individual Needs

Dr. Seo-Rin Ko

### *Residency Training:*

*2004-2006 Department of General Surgery, Altona General Hospital Hamburg  
since 2006 Department of Thoracic and Vascular Surgery, Altona General Hospital Hamburg*

*address: Fahrenort 72, 22547 Hamburg, Germany  
email: koseo@t-online.de*

### ABSTRACT

Vascular surgery involves either an artery or a vein. When the surgery is done from within the blood vessel, it is called endovascular surgery.

Endovascular surgery is a relatively new, less-invasive procedure for treating the two major problems that can develop in blood vessels: an aneurysm and a narrowing (also called an occlusion or stenosis).

An aneurysm is a weakness in a major blood vessel that causes a portion of the vessel wall to balloon out. Narrowing, or occlusion, is another condition that can occur inside an artery or a vein.

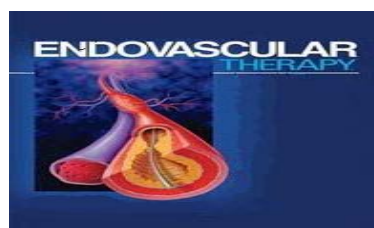
In the most two endovascular procedures: angioplasty and stenting, a long plastic tube called a catheter is placed into the femoral artery in the groin. Using X-ray imaging the catheter is advanced to the aneurysm or occlusion.

In an angioplasty, a small balloon is inflated inside the narrowed blood vessel. The balloon helps to widen the blood vessel and improve blood flow. After widening the vessel with angioplasty, sometimes a stent is inserted depending upon the circumstances. Stents are tiny mesh tubes that support the artery walls to keep the vessels wide open.

Endovascular surgery is attractive compared to conventional surgery for two primary reasons: shorter recovery time and reduced patient risk.

Endovascular procedures may not be as durable as many of the conventional surgical approaches. Endovascular procedures have been widely used only since 1995. Therefore, the long-term results of endovascular surgery require further follow-up.

**KEYWORDS:** Endovascular surgery, aneurysm, occlusion, angioplasty, stenting



## RESUME

### 목헌

K. Hun Mok, Ph.D.

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# **Protein Conformation-Dependent Neurodegenerative Diseases: Underlying Molecular-Level Commonalities ("Mad Cows, Mad People, and the Mad Dash Towards Developing New Treatments")**

목 헌 (睦 憲; Mok, K. Hun)

*School of Biochemistry and Immunology, Trinity College Dublin, Dublin 2, Ireland*  
[Mok@mac.com](mailto:Mok@mac.com)

## **ABSTRACT**

A wide variety of neurodegenerative diseases such as Alzheimer's, Parkinson's, Huntington's, and the Prion diseases (including Bovine Spongiform Encephalopathy; BSE or better known as Mad Cow Disease) appear to commonly arise from aberrant conformational changes in their respective normally-functioning proteins. These mis-folded proteins then aggregate to higher-molecular weight components that are then further deposited in tissues. Electron microscopy of samples obtained from tissues arising from these diseases (commonly grouped as 'amyloidoses') strikingly show a common morphology of fibrillar structures that are typically long, unbranched and approximately 10 nm in diameter. X-ray fibre diffraction studies show that the constituting polypeptide chains are extensively in beta-sheets. That large molecular aggregates originating from different types of proteins (possessing different alpha-helix or beta-sheet content) can manifest in such a wide range of apparently-disparate, debilitating diseases is a remarkable fact we aim to exploit in hopefully finding drugs for treatment or prevention.

Work in our group has shown that such fibrillar aggregates are not solely within the realm of proteins associated with diseases. In fact, we have been able to produce amyloid-like fibrils from proteins which have no known connection with any disease whatsoever. Furthermore, using peptides of various properties, we have been able to demonstrate the capability of designing biological nanostructures that confer interesting properties.

**KEYWORDS:** neurodegenerative disease

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## **SESSION 2**

### **Computer sciences, Electronics, Information Technology**

#### **Chairs**

Dr. Hae-Yeong LEE (Microsystems, ASCoF),  
&  
Dr. Il-Song HAN (University of Sheffield, KSEAUK)

## **RESUME**

**SongYean Cho**

Ph.D candidate at Lix in Ecole Polytechnique (2005~2006)

Research Engineer in Samsung Electronics (2000~2005)

KOREA UNIVERSITY, Seoul, Korea

M.S. in Computer Science and Engineering (1998~2000)

KOREA UNIVERSITY, Seoul, Korea

B.S. in Computer Science and Engineering (1994~1998)

# Association Discovery Protocol for Hybrid Wireless Mesh Networks

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## ABSTRACT

Wireless Mesh Networks (WMNs) have been proposed as a prominent network solution for ubiquitous networks[1], and industry standard groups such as IEEE 802.11, 802.15 and 802.16 are working new specifications for WMNs. The recent intensive researches about MMNs are based on two major features of WMNs. First, WMNs are organized without requiring network administrators, and can be deployed with minimal preparation. It is because mesh router, one component of WMNs assist each other in forwarding packets by organizing multi-hop networks automatically. Second, WMNs enable mesh clients to access networks even if mesh clients cannot execute any routing protocol. Instead of operating complex routing protocol, clients simply associate themselves with mesh routers and rely on mesh routers to access the whole WMNs. Permitting the mesh clients' participation also presents another opportunity, supporting heterogeneous networks. Because mesh clients in different networks can associate with mesh routers connected each other, mesh routers can find paths between mesh clients in heterogeneous networks.

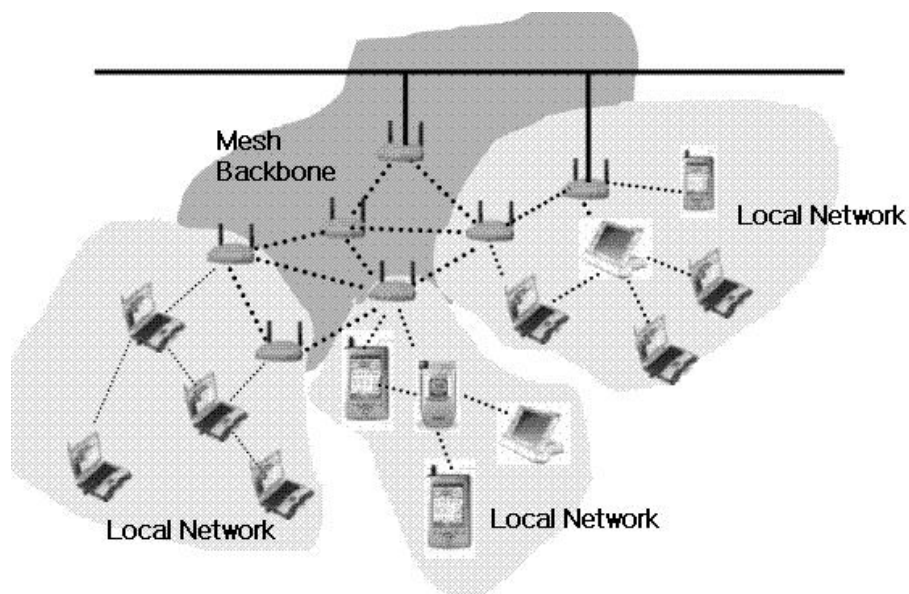


Fig. 1. Architecture of hybrid wireless mesh networks

As shown in figure 1, two main components of WMNs are the mesh routers and mesh clients. Mesh routers organize self-configuring and self-healing networks by executing routing protocols. The routing protocols for WMNs are not much different from those of wireless ad hoc network in general and Mobile Ad hoc NETWORK (MANET) in particular. For MANET, several routing protocols such as OLSR, AODV, TBRPF and DSR have been proposed, thus we can utilize these protocols for WMNs. Unlike mesh routers mesh, clients should associate

with mesh routers to access networks. To associate with mesh routers, mesh clients use specific attachment protocols such as page/inquiry for Bluetooth or association request/reply for IEEE 802.11. To permit the mesh clients participating in WMNs, mesh routers should execute different operations from that of the classical MANET protocols. Because information exchanged by MANET routing protocols is for a flat topology, it is insufficient to find paths between mesh clients in a hybrid structure. To collect complementary information, mesh routers execute the association discovery protocol (ADP) proposed in this article. In summary mesh routers in our solution execute two protocols: the mesh routing protocol and the ADP. By executing these two protocols, mesh routers can compute both routes (hence the routing table) to other mesh routers, and routes to the mesh clients associated by to these other mesh routers (by means of an association table). In addition, the second information to compute routes for mesh clients is stored and maintained in two kinds of information base:

- Local Association Base (LAB): Each mesh router keeps track of mesh clients associated with itself. This information base is updated whenever associated mesh clients leave or new mesh clients join. Additionally, to provide support for a large number of mesh clients, each mesh router can divide its LAB into several blocks and distribute them block by block if the need arises.
- Global Association Base (GAB): Each mesh router maintains a GAB to record which station is associated to which mesh router in the entire WMNs. Upon receiving LAB from all other mesh routers, the GAB is updated. Hence the GAB should contain the union of the all LAB, of each mesh router in WMNs.

To distribute mesh routers' LAB, the mesh routers broadcast their full LAB periodically. These periodical additional messages create overhead. Considering that a LAB is not modified when there is no new association or disassociation, all mesh routers do not need to distribute their full LAB periodically. When mesh routers' LAB changes, they distribute their LAB, but the irregular distribution of LABs may make mesh routers' GAB inconsistent even if they decrease the overhead. To achieve the two goals: decreasing the overhead and keeping GAB's consistency, the ADP proposed provides two operating modes: full and checksum.

Initially mesh routers operate in full mode. If mesh routers do not sense any change in their LAB, mesh routers start to operate in checksum mode. Any change in their LAB sets mesh routers back to operate in full mode. To decide an appropriate moment to switch two operation modes, mesh routers should decide a criteria to improve Packet Error Rate (PER) and control overhead. In other words, mesh routers choose  $t_i$  to minimize PER decrease and overhead increase using the following formulas.

$$\sum_{(i,j) i \neq j} \frac{v^\alpha \times B_i}{\pi A} L_i^\alpha \times h_j \frac{r^t}{(1-r^t)(1-r)} \times \frac{v^\beta \times B_i}{\pi A} e^{-(2N \times \tau_i \times h_i) \times t_i} (C_1 \sum_{\alpha} \tau_j^\alpha L_j^\alpha - C_2)$$

$h_i$  : mesh router i's control message distribution interval

$t_i$  : the number of message intervals required to switch mesh router i's operation mode from full to checksum.

$A$  : total network area and  $A_i$  : area which mesh router i covers

$B_i$  : the border length of the area which mesh router i covers

$L_i$  : a mesh client associates with a mesh router i

$T_i$  : the number showing how often a mesh client sojourns with mesh router i

$V^\alpha$  : speed at which mesh client moves

$N$  : total number of mesh clients

$C_1$ : byte number with which mesh routers represent each client status

$C_2$ : byte number with which mesh routers represent all client status in checksum

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## RESUME

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## ***Integrated Information System Supporting Energy Action Planning via the Internet***

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### **ABSTRACT**

Recent energy policy is designed to foster energy efficiency and assist with the deployment of clean energy systems, especially those derived from renewable energy sources. To attain the envisaged targets will require action at all levels and effective collaboration between disparate groups such as policy makers, developers, local authorities, energy managers, building designers, consumers etc. To support such collaborations, an Internet-enabled energy information system, termed EnTrak, has been developed. The aim is to provide decision-makers with information on energy demands, supply potentials and environmental impacts by sector, time and fuel type. Such information may be employed in support of routine energy management and future action planning. This paper describes the capabilities, structure and application of the EnTrak system. The applicability of EnTrak was tested using real data collected at different scales: regional, municipal and institutional. The outcomes from these analyses demonstrate the potential for global support for decision-making at all levels.

Based on the capabilities of the EEIS as demonstrated in this study, it is envisaged that a collaborative system for sustainability between citizens, organisations, professional groupings and utilities could be established on a real-time basis. Such a system will enable a global analysis based on aggregated data derived from the on-line integration of distributed databases and allowing two-way information flow between decision makers and with the entities being managed (e.g. remote control of demand). Most importantly, such an on-line collaborative system can be implemented at low cost by utilising the rapidly growing Internet infrastructure.

**KEYWORDS:** Integrated information system

## RESUME

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# Image Navigation and Registration System for GEO Observation Satellite

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## ABSTRACT

The COMS (Communication, Ocean and Meteorological Satellite) is a hybrid geostationary satellite, which is being developed by KARI (Korea Aerospace Research Institute) and is scheduled to be launched in the end of 2008. It accommodates multiple payloads of MI(Meteorological Imager), GOCI(Geostationary Ocean Color Imager), and the K-band Communication Payload into a single spacecraft platform. The COMS mission is to provide Korea with the following services for the mission lifetime of at least 7 years: meteorological service, ocean monitoring, and satellite communication. The meteorological mission of the COMS includes continuous monitoring of meteorological imagery and extracting of meteorological products with high resolution and multi-spectral imager. The meteorological image and data obtained by the COMS will be distributed to end users in Asia-Pacific area and it will contribute to the improved weather forecast. The second mission is the oceanographic image and data gathering for marine environment monitoring around Korean Peninsula by using an eight channel Geostationary Ocean Color Imager (GOCI). The COMS is going to be the first satellite for ocean monitoring mission on the geo-stationary orbit.

In order to meet the requirements of highly leveled-up geometric image quality for the MI and GOCI the COMS system will have the INR (Image Navigation System and Registration) system whose goal is to determine the location of any pixel within an image in terms of Earth longitude and latitude, and to maintain absolute and mutual longitude and latitude spatial relationships within and among images. That is, after INR processing, each image pixel has the same longitude and latitude regardless of time and, therefore, pixels corresponding to geopolitical boundaries appear as a fixed grid in all images all the time.

The GOES INR system consists of a semi-closed loop system with a ground-based segment that generates coefficients to perform image motion compensation (IMC). The IMC coefficients are uplinked to the satellite-based segment, where they are used to adjust the displacement of the imagery data by moving the scan mirror of the imager instrument. The COMS INR system does not adopt this solution due its intrinsic lack of robustness against non repeatable pointing errors and the imager-associated operational complexity caused by frequent upload of corrective parameters. To fulfill COMS requirements, another approach based on a posteriori ground processing will be used: systematic and accurate correction that is integrated in a loop to iteratively refine the geometrical and navigational models. This approach, which has been successfully implemented within MSG (Meteosat Second Generation) system, is proposed with an objective of favoring robustness and flexibility.

This paper describes the overview of the COMS INR system including its architectural design, INR performance requirements, and comparative study with currently existing INR systems in other meteorological satellites. It also discusses potential error sources inherent in the INR system with performance budget analysis and its operational methods of compensating for these errors.

**KEYWORDS:** *COMS, GOES, INR, Image Navigation, Registration*

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## **RESUME**

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## **Bioinformatics... Past and Future**

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### **ABSTRACT**

Over 20 years, the vast biological data was produced and many biological databases appeared to deposit and analyse data. In the meantime, Human Genome Project (HGP) was completed in 2003. Through this consortium was identified gene of human DNA, determined 3 billion chemical base pairs in human DNA, stored them and developed data analysis tools. At the Post-Genome era, it is still lots of work to unveil 'true' information.

Bioinformatics is essential component of 'silicon-based' biology and contributed to analyse huge amount of biological and medical information. At this talk, it will be introduced history, availability, future application of bioinformatics to understand a part of recent biological research for finding mechanism of disease and target gene/protein correlated with disease.

**KEYWORDS:** bioinformatics

## RESUME

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## Study on COMS AOCS Maneuver Realization

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### ABSTRACT

The AOCS (Attitude and Orbit Control Subsystem) of COMS (Communication, Ocean and Meteorological Satellite), currently being designed and developed by the joint effort of EADS Astrium and KARI, is fundamentally based on EADS Astrium's Eurostar 3000 avionics heritage. Some of the mission requirements and features in COMS, however, demand much further and thorough investigation and analysis in AOCS design and implementation:

- The accommodation of two optical instruments in COMS, MI and GOCI, pose much higher complication to AOCS, which should be accordingly modified, fine-tuned and improved from Eurostar 3000 AOCS, both in hardware and software.
- The single-solar-wing configuration of COMS is new to its overall structural architecture, and this unbalanced spacecraft configuration is much more sensitive to the disturbances and thus the design should be able to secure the stability of spacecraft both in terms of its orbit and attitude.

More specifically, the thruster mode control among the AOCS functions play a key role in maintaining this orbit and attitude stability because the COMS mission operation scenarios require momentum unloading ('off-loading') on the daily basis and station-keeping maneuvers on the bi-weekly basis, at least, by thruster firings.

In this paper, the AOCS thruster control design aspects are considered in this regard and its impacts to orbit, attitude and operational constraints are investigated.

**KEYWORDS:** AOCS, Thruster control, Station-keeping, Momentum unloading, Maneuver realization

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Koreanischer  
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## **SESSION 3**

### **Mechanical Engineering, Materials**

#### **Chairs**

Dr. Yongmann M CHUNG (University of Warwick, KSEAUK)

&

Dr. Wonsun PARK, (Leibniz Institute of Marine Sciences, VeKNI)

## RESUME

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## Numerical Simulations of Unsteady Turbulent Flows

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### ABSTRACT

A detailed numerical study of transient turbulent wall-bounded flow for investigating unsteady coherent near-wall structure are performed. Temporal acceleration (and also deceleration) of turbulent boundary layer is studied using DNS, LES and URANS. The main focus of the study is to develop a high-quality DNS database for transient turbulent flow, which is then used in testing and assessing popular turbulence models and LES wall models for unsteady turbulence for industrial use. The test cases described below have a high importance in engineering and will improve the understanding of the flow physics of transient turbulent flow.

Direct numerical simulations are performed for a temporally accelerating (and also deceleration) turbulent pipe flows. The calculations are started from a fully-developed turbulent pipe flow. For the acceleration cases, the Reynolds number increases due to flow acceleration from  $Re_0=7000$  to  $Re_1=45,200$ , and the Reynolds numbers based on the friction velocity ( $u_\tau$ ) are  $Re_\tau=230$  and 1190, respectively. Preliminary LES simulations have been performed with a  $128 \times 193 \times 256$  grid system and DNS is also applied to a lower Re number. The responses of the turbulence quantities (e.g., turbulence intensities, Reynolds shear stress, and vorticity fluctuations) and the near-wall turbulence structure to the pressure gradient change are investigated. It is found that there are two different relaxations: a fast relaxation at the early stage and a slow one at the later stage. The early response of the velocity fluctuations shows an anisotropic response of the near-wall turbulence[1]. Four turbulence models are tested in this study: the S-A model, the  $k-\omega$  model, the  $k-\varepsilon$  model, the Baldwin-Lomax model. The preliminary DNS results of transient channel flow are shown below.

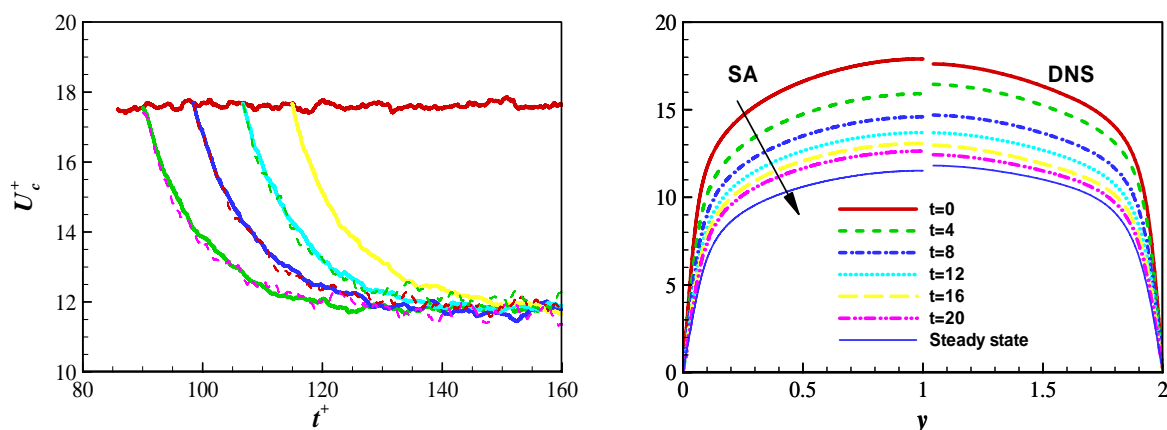


Figure 1. Time history of the centreline velocity  $U_c$  using DNS. Symbols represents steady channel flow, solid lines represent transient cases. (b) Streamwise velocity at several time instants using DNS and the S-A turbulence model.

[1] Chung, Y. M. 2005 *Int. J. Num. Meth. Fluids* **47**, 925-930.

**KEYWORDS:** turbulent flows

## RESUME

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Polymer processing  
Mechanics of composite materials  
Optimization methodology (genetic algorithm)

## HEAT TRANSFER ANALYSIS IN COMPOSITE TAPE LAY-UP PROCESS

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### ABSTRACT

Composite material is known to possess superior mechanical properties and thus is gaining more popularity as structural material in the aerospace industry. One of the major difficulties in widening the application of composite material is the productivity of manufacturing processes. Considerable efforts have been made to reduce the manufacturing cost and to enhance the productivity. One of the candidates to meet these needs is composite tape lay-up process. In this process composite prepreg tapes containing fiber and resin mixture are laid up in a specific pattern. In order to bond the prepreg tapes, heat and pressure must be applied during the process. During the tape lay-up process, by the local heat source, bonding takes place under pressure by the compaction roller. Therefore, without heat transfer analysis on consolidation, it is impossible to predict the quality of bonding. Good bonding between the plies is crucial for sound composite structures. Therefore the objective of this study is to investigate numerical means to analyze the temperature field inside the composite during composite tape lay-up process.

Composite prepreg was taken to be a homogeneous, anisotropic material. As the roller/torch assembly moves at a constant speed  $U$ , the problem was assumed to be quasi-steady with coordinate system moving also the same constant speed. Considering the anisotropy of the thermal conductivity, the governing equation can be written as

$$\rho c U \frac{\partial T}{\partial x} = \nabla \cdot (\tilde{K} \cdot \nabla T)$$

Here  $\rho$  and  $c$  are density and specific heat of prepreg, respectively.  $\tilde{K}$  is the thermal conductivity tensor and  $x$  denotes the direction along the prepreg.

To analyze the heat transfer problem with complicated geometry, Finite Element Method (FEM) was employed. In the governing differential equation, the first derivative term  $\partial T / \partial x$  is present. In this case, there is a possibility of numerical instability during calculation. Therefore, to ensure stability of the solution, Streamline-Upwind/Petrov-Galerkin method was employed. Thermophysical properties of the composite may depend upon the temperature in a nonlinear manner. Therefore the solution requires iterative calculation. In this study, Newton-Raphson iterative scheme was employed.

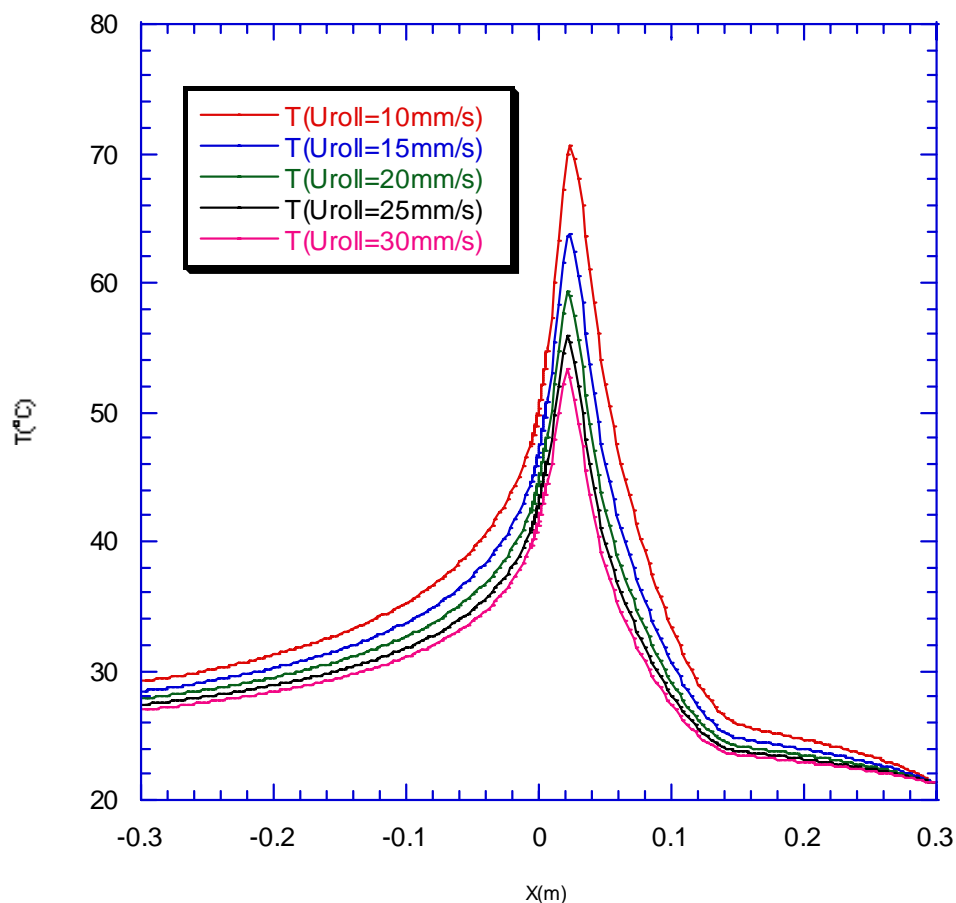
Since nozzle exit velocity is very high, flow becomes turbulent. In order to analyze the turbulent flow problem, the standard  $k$ - $\varepsilon$  model was employed. Two types of nozzles were

used. One has a V-slit on the bottom surface of the nozzle in order to preheat the composite substrate. Second type is the nozzle without the V slit.. The temperature distributions in the composite were obtained for different nozzle shapes, nozzle exit gas temperatures and velocities, layup speeds. One of the results for graphite/epoxy prepreg is demonstrated in the figure.

As the nozzle angle is increased, heat transfer coefficient becomes larger and peak temperature also becomes higher. However, when the nozzle with V-slit was used, heating zone of the composite substrate became wider than that of the nozzle without the V-slit. Peak temperature became higher as the nozzle exit temperature and gas increased and the roller speed decreased.

**KEYWORDS:** Composite prepreg, Tape lay-up process, Productivity, Heat transfer analysis, Quality of bonding

Temperature Distribution (Nozzle with V-slit)  
 $V_{noz}=20\text{m/s}$ ,  $T_{noz}=250^\circ\text{C}$



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## RESUME

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# Ceramic Micro Combustion Engine Design and Fabrication

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## ABSTRACT

Hydrocarbon fuels have 130 times more energy than batteries in average. A microengine can release the energy for applications in portable devices and greatly extend the using time. The applications of the microengine will not only be limited to notebook PC, mobile phones, PDA and micro air vehicles, but will also enable new power hungry portable devices to be developed. The potential impact of the microengine cannot be over estimated. The research presents an investigation in the micro combustion engine design and the challenge in fabricating high temperature resistant engine components. Two stroke piston engines are designed to suit the 2-D MEMS fabrication. Since alumina ceramic exhibits excellent thermal properties, it is selected as the engine construction material. Although micro metal injection moulding (mMIM) can produce complicate microcomponents, the shrinkage as high as 20 % makes it difficult to produce precision components meeting a high tolerance which required as engine components. The research has adopted a strategy to produce high precision micro moulds and then to fabricate near net-shape ceramic microcomponents using the moulds. The precision moulds were fabricated by using SU-8 photoresist through UV photolithography process. Alumina engine microcomponents were achieved by firstly sintering Al microcomponents using micro/nano powders, and then turning Al into alumina (Al<sub>2</sub>O<sub>3</sub>) through oxidation. In this way, the shrinkage occurring in sintering the Al powder is compensated by the expansion occurred when Al transforms into alumina. The process has proven successful. Achieved near net-shape alumina microcomponents have overall shrinkage ratio about 2.0 %. With some modifications, the proposed method could be adopted for producing net-shape metallic and ceramic microcomponents.

**KEYWORDS:** micro combustion, engine

## RESUME

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## **Indirect Search for Dark Matter with AMS-02 Detector on the International Space Station**

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### **ABSTRACT**

According to the standard modern cosmology and recent astrophysical observations, the universe is composed of 22% non-baryonic cold dark matter and its nature is one of the outstanding questions in the astro-particle physics. Beyond the Standard Model of particle physics, supersymmetry (SUSY) theories predict the existence of the relic particles from Big-Bang and the lightest supersymmetric particle (LSP), called neutralino, might be a favored particle candidate for the non-baryonic cold dark matter. If the neutralino dark matter is distributed in the galactic halo or center, it would produce a distinctive characteristic energy spectrum of the cosmic positrons, anti-protons and gamma-rays by neutralino annihilations. The Alpha Magnetic Spectrometer (AMS) is the high energy particle physics experiment to measure the cosmic-rays on the International Space Station (ISS) in 2008 for a period of three to five years. After a brief description of the AMS-02 detector, a major physics potential for the dark matter search using a precise measurement of the positron flux will be presented. The AMS experiment is supported by the German Space Agency (DLR) under contract number 50000501.

**KEYWORDS:** AMS, Dark Matter, Neutralino, Cosmic-rays, Positron

## RESUME

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# COLUMNAR TO EQUIAXED TRANSITION DURING DIRECTIONAL SOLIDIFICATION PROCESSING IN ALUMINIUM ALLOYS

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**KEYWORDS:** Columnar to equiaxed transition, Directional solidification, Natural and forced convection.

## Abstract

The growth forms observed in aluminum alloy casting by industrial processing cover a range of different type of dendritic microstructures, from columnar to equiaxed grains. The structure is called columnar if the growth is oriented in one direction, whereas equiaxed grains are freely growing in all space directions, leading to a material with more isotropic macroscopic mechanical properties and a more homogeneous composition field than columnar microstructure. Depending on the application, one type of grain is preferred and thus favored. In car engines, a fine dendritic equiaxed microstructure is required. Conversely, columnar growth is desired in superalloy turbine blade casting.

The understanding and control of the transition from columnar to equiaxed structure (CET) are key points to obtain desired final properties of industrial products. The main objective of this investigation is to clarify the CET phenomenon and the parameters involved to better monitor CET. Two different aluminium based alloys are chosen in order to study the effect of the solute: Al-3.5wt%Ni and Al-7wt%Si with and without refining particles (particles added to promote equiaxed nucleation).

Several experiments are carried out in a Bridgman-Stockbarger furnace for which the thermal gradient and pulling velocity can be independently controlled. In the first series of experiments, CET is provoked by a sharp or slow velocity jump at a constant thermal gradient and we compare the results obtained with the different alloys.

In addition, real time and in situ solidification with a unique experimental set-up combining X-ray radiography and topography has been developed at [European Synchrotron Radiation Facility](#). These results are discussed in relation to available models and used for simulations under the condition of natural convection.

This work is part of the CETSOL project and the authors would like to thank ESA (European Space Agency) for their financial support.

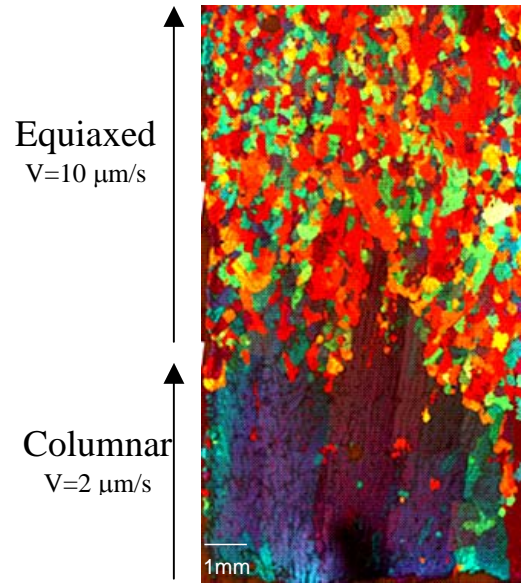


Figure. CET in a refined Al-3.5wt%Ni alloy solidified at  $G=20\text{K/cm}$  with a pulling rate jump from 2 to 10  $\mu\text{m/s}$ .

The 2<sup>nd</sup> European conference of Korean Scientists and Engineers in Europe, November 4, 2006, Paris, France  
In the memory of the 30<sup>th</sup> anniversary of ASCoF

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# Comparison of High Temperature Corrosion Behaviour of Superheater Materials and Reactivity of Biomass Ashes in Biomass Combustion

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## ABSTRACT

*The aims of this work are to investigate the corrosion behaviour of ferritic and austenitic superheater materials and the reactivity of filter and cyclone ashes from the biomass combustion plant in the biomass combusting atmospheres. The materials were exposed in three different settings: samples without deposits, with filter ash and cyclone ash. Exposure tests were carried out with variation of H<sub>2</sub>O and HCl content for 360 hours at 535°C. Subsequently the mass losses of materials were determined and the corrosion products were analyzed by FEM-EDX. Furthermore, the exposed ashes were analyzed in C-, Cl- and S-content by ICP-AAS.*

*As results, the HCl addition led to higher mass losses of materials than those without HCl addition due to HCl enhanced oxidation. The rate of mass loss is proportional to the aggressiveness of deposition. Increasing of H<sub>2</sub>O content led to increase of the mass losses in the HCl containing atmospheres, caused by water induced corrosion. The corrosion resistances of superheater materials depend on the Ni-, Cr-, Si- and Mo-content, which have the positive influence on the corrosion behaviour. Concerning the reactivity of biomass ashes, the alkali chloride could be formed from alkali carbonate in the HCl containing atmosphere and this accelerated the oxidation process. In contrast, in the HCl free atmosphere, alkali carbonates and hydroxides can be formed, so the enhanced oxidation concerning the alkali chloride does not occur. In conclusion, the formed alkali chlorides in the atmosphere of biomass combustion are stable and subsequently can work as catalyst to oxidation process.*

**KEYWORDS:** Biomass, Ferritic-, Austenitic steel, Super alloy, Water-, HCl-effect

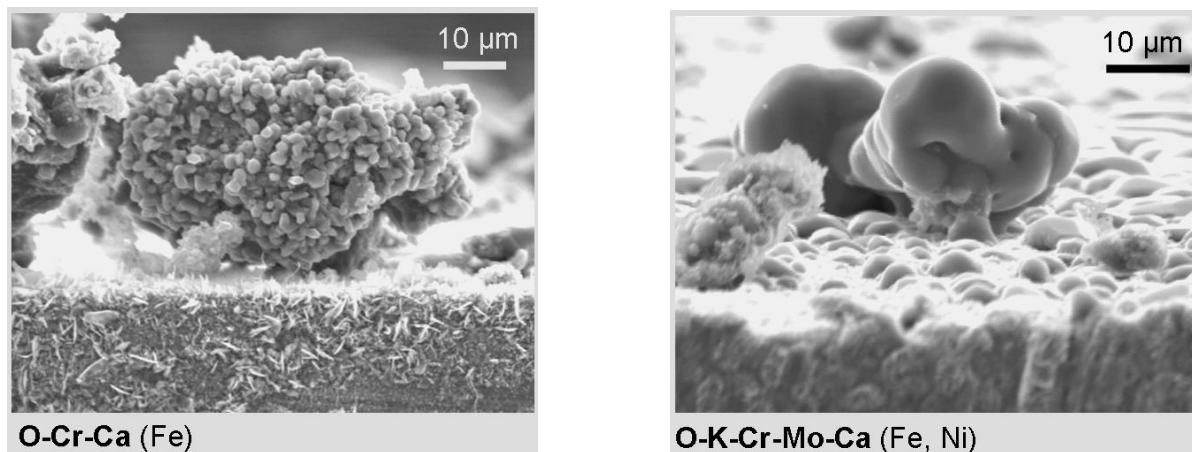


Fig.: Corrosion products on the TP 347 H (left) and Sanicro 28 (right) in biomass combusting atmospheres.





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