The 47th Clayteam Seminar/ EBIS Workshop/ Next-Generation-Synchrotron radiation Workshop

"Development, Evaluation and Standardization of Nanomaterials"

<Short Abstract>

[Speaker1] **"The next-generation synchrotron radiation facility 'NanoTerasu'- Enlighten the Nano Universe to Drive a Sustainable World –"**

Junichi Kawamura, Vice President of Photon Science Innovation Center (PhoSIC)
Professor Emeritus of Tohoku University

The next-generation synchrotron radiation facility "NanoTerasu" is going to operate in Sendai Aobayama Campus of Tohoku University, in 2024. The strong and brilliant X-ray beams generated from the synchrotron will be used for the analysis of various materials in nano-meter scale. The 3GeV ring of NanoTerasu has a special merit in soft-X-ray region, where light elements as Li, B, C, N, F, O etc. are easily detected and their chemical nature will be precisely analyzed, which is compliment of the hard-X-ray oriented facilities as Spring-8. High coherence of the NanoTerasu X-ray gives another merit to observe 2 or 3 dimensional pictures or movies of substances in nano-meter scale. NanoTerasu is served not only for academic use but also for public purpose as industry, pharmacy, food science, agriculture etc. For this purpose, the NanoTerasu is constructed and managed by a public-private regional partnership scheme, which is the starting point of the construction of a new Research Complex in/around Sendai City in future.

[Speaker2] **"Functionalization of SONA through the incorporation of heterocomonents"**

Makoto Ogawa, Prof., School of Energy Science and Engineering,
Vidyasirimedhi Institute of Science and Technology (VISTEC)

After the discovery of SONA (Silica with Oriented Nanopore Array, more commonly known as mesoporous silicas and the initial developments on this class of materials were known as MCM-41 and FSM-18) in 1990', the preparation, characterization and application of SONA have been extensively done. Taking advantages of the large surface area, high porosity, uniform/controllable pore size, and surface modification as well as their morphosyntheses of powder and films, functionalization of SONA by the incorporation of functional units has bee examined. Functional units so far immobilized in the pore vary from ion/molecule to polymer and nanoparticles. It is possible to incorporate multiple functional units to create functional SONAs. In this lecture, examples of the functionalized SONA will be introduced.

[Speaker3] **"Aerosol deposition with RTIC phenomenon and its application"**

Jun Akedo, Dr., Prime Senior Research Scientist, Device Technology Research Institute, AIST

Coating processes that are thought to utilize purely collision pressure or impact force such as aerosol deposition (AD) method and cold spray (CS) method are attracting attention. These accelerate microparticles and ultrafine particles by carry gas to several hundred m / sec or more, make them into a jet stream and collide with the substrate, realize dense coating with good adhesion just by supplying purely mechanical energy. It is thought that fine particles of metals and ceramics are macroscopically bonded at room temperature while remaining in a nearly solid state. In fact, it has been confirmed that, in the aerosol deposition method, it is possible to form a dense ceramic thin film or a thick film having a microcrystal structure of several tens of nanometers or less at room temperature and to obtain excellent electromechanical properties. Then, in the field of semiconductor manufacturing equipment, it has been commercialized as an important coating process. This is called "Room Temperature Impact Consolidation (RTIC)". When viewed as a powder forming process, this phenomenon is fundamentally different from a thermal spray coating and shock compaction in which raw material particles are brought into a molten or semi-molten state to obtain bonding between primary particles.

In this presentation, the deposition mechanism of the AD process with RTIC phenomenon and the importance of this phenomenon for the future coating technology are explained.

[Speaker4] **"*Nanomaterial evaluation and prototype platform* and standardization of clay nanoplate"**
Takeo Ebina, Dr., Director-General, AIST Tohoku

AIST Tohoku, a public research institute located in Sendai, is working on resolving social issues and improving industrial competitiveness in the Tohoku region with resource recycling technology as its flagship theme. AIST Tohoku is also the center for international standardization of nanomaterials in Japan. AIST Tohoku will start operation of the nanomaterial evaluation and prototyping platform in FY2023. This platform is equipped with more than 20 analytical and prototyping instruments, enabling efficient development and evaluation of nanomaterials. We will work on the industrial use of this platform under the cooperation with NanoTerasu. This platform and our work on silica/clay nanomaterials standardization will be introduced.

[Speaker5] **"Nanocomposites for Insulating Materials: Specification of Characteristics and measurement methods "**
Muneaki KURIMOTO, Associate Prof., Graduate School of Engineering Nagoya University

The emergence of nanocomposites as insulating materials has made a substantial impact on the electric power and electronics sectors. The advantages of nanocomposites, compared to conventional insulating materials, include improved insulation characteristics that enable enhanced performance and downsizing in rotating machines, switchgear, power cables, and power modules. This presentation provides a comprehensive overview of the specifications of characteristics and measurement methods of nanocomposites.

[Speaker6] **"Nanocomposites for Insulating Materials: Applications"**
Takahiro IMAI, Dr., Industrial Systems & Materials R&D DepartmentInfrastructure Systems Research and Development Center, Toshiba Infrastructure Systems & Solutions Corporation

The advent of nanocomposites for insulating materials continues to have an impact on electric power and electronics sectors. Advantages of the nanocomposites compared to conventional insulating materials in insulation characteristics will enable high performance and downsizing in rotating machines, switchgear, power cables and power modules. This presentation provides detailed coverage on applications of nanocomposites.

[Speaker7] **"Synthesis and electrical properties of graphene toward high performance devices"**
Takatoshi Yamada, Dr., Nano Carbon Device Research Center, AIST

Graphene is expected as one of the most appropriate materials for electronic devices. It is necessary to develop mass production technique and to improve electrical properties of graphene for practical applications.
I will introduce a roll-to-roll plasma CVD system toward large area deposition and show some applications using the graphene transparent conductive films. Then, I will talk about potassium doping of graphene using KOH solution, which shows n-type conduction and high carrier mobility. The effect of strain and flatness of substrates on carrier mobility will be discussed to improve the electrical properties.