

Program ID: 2009S08

Title: Analysis of Dynamics at Nano Interface of Functional Soft Matter

Principal Investigator: Atsushi Takahara

Decision: continue

Beam allocation: $\beta = 70\%$

Approval and suggestion(s) to IMSS: Requested budget and resources are reasonable and should be supported by IMSS

Outline of this proposal:

Interfaces of soft matters are complicate and interesting: Behaviors of polymer blushes at solution interfaces, phase separation in thin films of polymer blends, wetting and de-wetting phenomena of polymers at surfaces, diffusion of polymers in thin films, structures of meso-porous materials and dynamics of their structure formations and so on. A high-power pulsed neutron source and a high-performance reflectometer is unique technique to approach dynamical aspects of interfaces of soft matter.

This proposal, 2009S08, is a strongly-motivated plan to promote studies of dynamics of soft matter interfaces with a horizontal reflectometer, ARISA-II, which was moved from KEK and has been started its operation from 2009, and with a new reflectometers, which will start its operation in 2010. For a new reflectometer, options such as time-transient measurement, grazing incident small-angle scattering (GISANS), Spin-echo and polarized neutron measurement are planning. Longtime effort of reflectometer group will finally pay off soon and it is promising that measurement of interface dynamics will be realized.

Followings are highly regarded activities in 2009:

- **The research group**

It is well organized with distinguished researchers and it seems quite sure to achieve their purpose including the construction of a new reflectometer.

- **Commissioning of ARISA-II**

Especially background reduction by introducing a disk chopper has been progressed. So far, ARISA-II can measure reflectivity down to 10^{-6} . It should be noted that the group has started user program in short time.

- **Polymer science**
Investigations of swelling mechanism of polymer (PMPC) and diblock-copolymers (PDMS-PEG) are on going. These measurements show that the intensity of ARISA-II is about 100 times higher than ARISA (KENS) at 100 kW operation of J-PARC: minutes order measurement is enough to obtain data for qualitative analysis. On the other words, dynamical investigations of interface, at which this proposal is aiming, is feasible.
- **GISANS option**
Test experiments of GISANS were started by a 2-D detector of ZnS/⁶LiF scintillator with reference photon photomultiplier tube (RPMT). It is expected to start user program in 2010.
- **Incident beam control with neutron super-mirrors**
This realized multiple incident angles and increase of measurable thickness of interface. Also, new apparatus of solid/liquid interface is under consideration.
- **Development of a new two-dimensional He-gas detector**
High efficiency and high counting rate 2-D detector is under development. It is MicroStrip Gas Chamber (MSGC) and can be a world's best suited detector for neutron reflectometry. However, shortage of ³He-gas should be considered.

Comments from PAC for 2010:

- **Sample Environments**
It is necessary to prepare a sample exchanger, high and low-temperature cell, horizontal trough and so on. (Such environments are under development)
- **User Program**
In summer shutdown period of MLF neutron target, new reflectometer will be installed. This proposal is planning re-start its user program after 30 days commissioning. It is believed that the commissioning period was carefully decided based on experience of ARISA-II but it is recommend to be careful to re-start the user program.