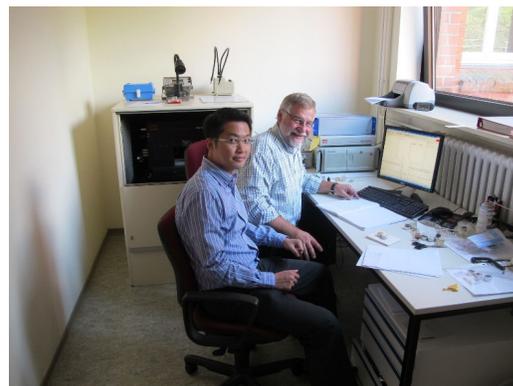


Summary of my research visit to BAM Federal Institute for Materials Research and Testing (BAM), Berlin between 22 August – 2 September 2011:

The research visit was part of the award I received from the WMRIF at the 2nd International Workshop for Young Materials Scientists held at BAM in late August 2010. As one of the awardees from the workshop, I was kindly invited to spend my two weeks research at BAM. During the research period, I worked under the supervision of Dr. Michael Griepentrog, a research scientist of the Thin Film Technology, Electrochemistry, Surface Measuring Techniques Working Group, on a research topic entitled “Dynamic characterisation of viscoelastic material using a nanoindentation”. We had an in depth exchange on the application of nanoindentation technique. In particular, I have learned about how to operate the nanoindenter (MTS Nanoindenter XP system) with different indenter tips and testing modes, how to calibrate the area function in order to obtain the correct elastic modulus, testing limitations of the nanoindenter and also got some hands on performing tests on many standard samples, i.e. fused silica, sapphire, aluminium, polycarbonate, polyamide as well as on the foam sample, which I brought with me from Thailand. The nanoindentation testing procedure was followed the well established international standard ISO14577 for metallic materials. However, for polymeric materials, there is not yet the established ISO standard. The preliminary results showed that the nanoindentation technique worked effectively on all standard samples in the sense that the experimental data were reproducible and the extracted moduli were very close to their true values. In contrast, for the foam sample, it was preliminarily found that results were not reproducible and were highly dependent on the location of contact. Such findings were likely caused by the fact that the foam sample was very compliant, highly porous and sticky with uneven topological roughness. Some solutions to resolve this problem were discussed and would be planned for future cooperative project. Furthermore, the possible collaboration on establishing the standardisation for the indentation of biomaterials, i.e. soft viscoelastic materials, was discussed. This work has been ongoing among a number of European institutes. In this respect, a future joint collaboration between BAM and National Metal and Materials Technology Center (MTEC) on the area of standardisation was offered.



(a)



(b)

Figure 1: (a) MTS Nanoindenter XP system (b) working with Dr. Michael Griepentrog.

In addition, I was given opportunities to many one-on-one discussions by a number of BAM researchers who work on a range of research areas for example on mechanical behaviour of materials, high rate testing, joined components using different kinds of welding techniques, material modelling, creep and fatigue testings, as well as measuring the Young's modulus of ceramic materials and lastly thin film technology and characterisation. Therefore, I have gained an exposure to a diverse spectrum of research activities and advanced testing equipments, which could be mutually beneficial for future potential collaborations between BAM and MTEC.

Overall, my two-weeks research visit at BAM was full of great experiences and was very educational. I am deeply thankful for the opportunity that WMRIF and BAM have given. My utmost gratitude also goes to Dr. Michael Griepentrog, who has been very kind and helpful in guiding me and whose work proved to be very enlightening for me. I am also confident that future WMRIF participants, particularly awardees will greatly benefit from the interactions provided by WMRIF. On the last note, I am very heartened by the friendliness and generosity of the people of Berlin and was very impressed with the interwoven of historical and culture backgrounds and high technology innovations eminent in Germany. I am also very amazed with the German concerns of recycling scheme and the extensive use of personal shopping bags at grocery shops.

Future co-operation:

- To continue working on the topic "Dynamic characterisation of viscoelastic material using a nanoindentation" and possibly on the standardisation work of the instrumented nanoindentation of viscoelastic materials
- To look for sources of fundings. Dr. Griepentrog is currently working on the project entitled "NANOINDENT" funded by the EU FP7 program. MTEC is also eligible to apply for funding from such program. Therefore, this program will be explored in order to extend future collaboration between the two institutes.

Prepared by Dr. Chaiwut Gamonpilas

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