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Highlights of the Second APEC Science and Technology Ministers' Conference

I. Foreword

The Second APEC Science and Technology Ministers' Conference was hosted by Korea mainly for discussing the development of human resource under the banner: Key Issue for Regional S&T Cooperation—Creativity and Mobility: Researchers Across APEC. On March 25-26 and July 9-11, 1996, Korea hosted two Ad Hoc Group conferences and on November 11 hosted the Science and Technology Senior Officials' Meeting. The Second APEC Scientific and Technology Ministers' Conference was held at the Shilla Hotel in Seoul on November 13-14, 1996. The Republic of China delegation participated in all these meetings under the leadership of Dr. Liu Chao-shiuan, chairman of the National Science Council of the Executive Yuan.

Besides participating in the Senior Officials' Meeting and the S&T Ministers' Conference, the ROC delegation also engaged in bilateral talks during the conference with the ministers or vice ministers of seven APEC member economies, including Malaysia, Indonesia, Korea, New Zealand, Thailand and Mexico.

II. The Conference

The Second APEC Science and Technology Ministers' Conference was chaired by Korean Science and Technology minister. There were 190 participants, including the ministers and their retinues from the 18 APEC economies and the staff of APEC Secretariat. After President Kim Yung Sam delivered his welcoming speech, the conference officially started it twoday agenda, which consisted of five major parts:

A. Keynote Speeches

The Korean Science and Technology minister was the first to deliver his speech, and he was followed by ministers of other economies, according to alphabetic order. Each speech lasted from five to eight minutes.

B. Thematic Discussion

The Korean Science and Technology minister made an introduction before the thematic discussion, which included vision, objectives, principles, work plan for implementation, and prospects.

After the ministers made their proposals, the Korean minister drew the following conclusions: proposing the Industrial, Scientific and Technological Work Group (ISTWG) to adopt the following measures for promoting exchange, creativity and mobility.

1. Establish, for reference of member economies, a data bank of post-doctorate studies, resources and facilities, and possible programs for cooperation.
2. Investigate the visible and invisible factors blocking the flow of S&T personnel in the Asia-Pacific region.
3. Welcome President Kim Yung Sam's concept, which was contained in his welcoming speech, of preparing the establishment of an 'Asia-Pacific Young Scientists' Camp.

C. Progress of Cooperative Programs

The conference listened to a statistical report made by Japan, the Lead Shepherd Economy of the ISTWG, on the progress of various plans, including those proposed in accordance with the industrial, scientific and technological action plan and the newly proposed plans. Afterward, the Australian delegate briefed on the S&T network plan. The participating ministers proposed that other plans like the study of calamity prevention and the effort of public health be strengthened.

D. Open Idea Forum

The forum centered on a paper about 'gender and technology'. After Professor Kettel of Canada's York University made a presentation, participants were enthusiastic in offering their views. All of them recognized the fact that women are less active in S&T circles in the Asia-Pacific region, that the promotion of women researchers are important, that obstacles to their participation in S&T studies should be removed, and that they should be encouraged to make their contributions.

E. The Seoul Declaration and the Joint Communiqué

1. The Seoul Declaration

a. All APEC member economies recognized that the economic growth and vitality in the region should be backed by science and technology and that enhanced science and technology is not only the source of economic vitality but also the assurance for sustaining the prosperity and permanent and balanced development.

b. Creative scientific and technological resources are indispensable to the enhancement of industrial production and the improvement of people's life and, therefore, a S&T policy should be directed at the feasibility of knowledge improvement and the encouragement of participation by young and potential students. The government, academic institutes and the industry should join hands to nurture talent and promote exchange.

c. APEC member economies agreed to make the strengthening of the creativity and mobility of Science Technology human resource a priority goal of cooperation among themselves. They hoped that, through careful planning, they could carry out, by the year 2001, their specific goals of shared use in Science Technology information and resource, of talent interflow, and of sucking young talent into the field of S&T development.

2. The Joint Communiqué

Besides the excerpts of conference proceedings and major decisions, the communiqué also includes a resolution that the Third Science and Technology Ministers' Conference would be hosted by Mexico in 1998.

After the chairman made a closing report, the conference ended amid a chorus of congratulations and thanks from the participating ministers.

III. Major Conclusions of the Conference

A. Accepting the report of Senior Officials' Meeting to the ministers' conference.

B. Confirming the industrial Science and Technology work group's follow-up report on the implementation of APEC Science and Technology cooperative programs and expressing that efforts should be made to establish a more effective regime for cooperation.

C. Issuing the Seoul Declaration and the Joint Communiqué.

D. Authorizing Mexico to host the Third APEC Science and Technology Ministers' Conference in 1998.

VI. Bilateral Talks

The ROC delegation took advantage of the opportunity to arrange bilateral talks outside the conferenc with Korea, Malaysia, Indonesia, New Zealand, the Philippines and Thailande and they have reached several consensuses.

V. Conclusion

A. The APEC Science and Technology Ministers' Conference is the only such conference in the world, having specific meaning. Although the various APEC member economies vary in the state of economic development and in Science and Technology strength, they amply realize the importance of Science and Technology development, international cooperation, and the sharing of resources.

B. The ROC delegation is gratified that it has been able to take part in heated discussions and in seeing its concrete proposals included in the joint communiqué. Besides, it has taken the opportunity to engage in bilateral talks with some nations to reach consensus.

C. When the previous conference was held in Peking, the Chinese Communists lodged one protest after another on procedures and wording, but this conference has gone quite peacefully and smoothly. One of the reasons is that science and technology is a topic beyond political interference. Another important reason is that APEC members have established the spirit of mutual respect and the conference procedures.

D. Officials of both the Ministry of Economic Affairs and the Ministry of Foreign Affairs have joined the delegation. Their professional participation has contributed to the success. The delegation also appreciate the well-thought-out arrangement and assistance made by the Taipei Mission in Korea.

The Forum of "Sciences vs. Humanities Dialogue" Begins

The National Science Council (NSC), for implementing the resolution of "establishing a 'science, technology and humanity dialogue forum' adopted at the Fifth National Science and Technology Conference held in September 1996, began to host a series of "science and humanity dialogue," once in a month.

The first one was opened at National Taiwan Normal University on the afternoon of December 13 with "Dancing on Network: Internet, NII, and Future Community" as its topic.Vice President Lien Chan was invited to make a speech. Participants in the dialogue included scholars, officials in charge of national science and technology affairs, executives of information enterprises, women work station operators, and disabled net surfers.

The topic was divided into four parts: (1) the mainstream content (including education, science and technology, communication, youth, rest and leisure, and culture), (2) remedies for groups neglected on the network (including disadvantageous groups, access to network by the disabled, culture and art, expositions by women), (3) Internet and NII impact on future society (including the way of thinking, lifestyle, political and economic behavior, cultivation of talent, mode of academic studies, rest and leisure, display of potential by the disadvantageous groups) and (4) how to face up to the rapidly developing NII environs and the network community?

The forum invited experts from science and humanity circles to discuss vital social, educational and academic topics. Through dialogue, they expressed their views on subjects at the level of sciences and humanities. These included the ethic problems in biomedicinal technology, socio-economic problems in sustained development, the problems of balance and integration between technological development and humanity education, the impact of humanity thought on technological development, humanity reflection in technological society, and relations of technological development to religious belief, social change, and national competitiveness. The NSC, which is in charge of this series of activities, will conduct, on rotation, the forum in central, southern, eastern and northern Taiwan in conjunction with universities and colleges of the place. Newspapers will also be invited. After published in newspapers, the results of the forum will be entered onto the network. Topics will be found from the forum for joint study by technologists and social scientists to form part of the NSC research agenda.

This activity is an NSC mechanism of interaction with the social public. It is characterized by traditional dialogue on a broadened basis built on network (called science, technology and humanity forum and net forum, for short). The NSC hopes that the content of the forum will be enriched through consensus to build up a forum atmosphere for humanity sciences. It calls on the public to cooperate with the NII plan to cultivate the net population and net application required for accelerating the Republic of China's net information development.

Establishment of SPM by PIDC, NSC, For Supporting Academic Studies and Industrial Development

Thanks to rapid scientific and technological progress, measurement in the manufacturing has developed from micron to submicron and gradually to *nm*. As a result, the traditional examining and measuring technology can no longer meet the requirement, spurring the development of new examining and measuring technologies. Scanning probe microscopy (SPM), whose atomic resolution makes special treatment for samples unnecessary, can carry out measurement under any circumstances. Since the advent of scanning tunneling microscopy (STM) in 1982, various forms of SPM have been developed and introduced into different fields of study. To greet the *nm* era, the Precision Instrument Development Center (PIDC) of the National Science Council (NSC) established, at the end of 1995, an surface examining laboratory. It introduced into Taiwan the atomic force microscopy (AFM), scanning nearfield optical microscopy (SNOM), magnetic force microscopy and other technologies in an effort to support domestic academic and industrial circles with leadingedge examining and measuring technologies.

The SPM is, in simple words, a technology to scan a sample with a computeraided and specially made probe for determining the surface characteristics of a material. Take AFM, for example. It works much like an oldfashioned phonographic disc. When the disc is running, the needle vibrates, releasing the signals recorded on the disc. In terms of AFM, the disc is the sample to be examined and the needle is the probe. So, the concept of SPM is not novel, but to get the nm resolution, it calls for coordinated support by leadingedge examining and measuring technologies.

AFM has become the most important technology in scanning probe microscopy, because it can show the surface structure and shape of the sample with high resolution and, unlike STM whose use is limited to electroconducive materials, can be used on any material. It is the best examining and measuring instrument especially for samples that cannot produce clear resolutions on traditional scanning microscopes. Now, the Precision Instrument Development Center has acquired the AFM capability for scanning its optical films of coating and assisting academic circles to study the characteristics of film materials like the quality of electroplate, as in the case of wafers, and the microdistortion areas on a high molecular film of coating.

SNOM is the only technology that can break through the limitations of optical defraction effect and obtain a resolution ten-fold better than the result obtained with traditional scanning microscopy. The technology is highly valued by optical research circles especially for its usefulness in analyzing electro-optical components and materials. The PIDC has developed an easy-to-use electric arc fiber tip puller and a probe with a diameter smaller than 0.1 um for receiving or transmitting nearfield signals. Meanwhile, it has also developed an apparatus for detecting and probing near-field optical signals. This apparatus can be lined to all AFM-controlled systems to boost the power of the original instrument for examining the optical characteristics of the surface of a mate-rial. It is expected that PIDC will complete a transmission mode of near-field optical microscopy with 50 nm resolution by the end of this year. Next year, it will develop a refrac-tionary type and join in the work of spectroscopy measurement.

As for magnetic force microscopy (MFM), it has become increasingly important because of strong market demand for high-density memory, not least because magnetic recording has become the widest applicable technology. Since the development of high-density recording technology has great market value, the technology for examining and measuring magnetic recording is equally vital. At present, the resolution of MFM is about nm 50, the best in the field. The Precision Instrument Development Center has similar capability for examining and measuring surface magnetism. It has been cooperating with the Institute of Physics of the Academia Sinica to examine and measure the surface distribution of magnetism on high-density recording film. In the future, it will link its study to SNOM technology to develop near-field magnetic microscopy.

In addition to the foregoing three microscopic technologies, the PIDC will go on to develop electrostatic force microscopy and scanning thermal microscopy in hopes to acquire the capability for examining and measuring all kinds of material. To meet the requirement of bio-medicinal studies, the PIDC will also engage in the work of examining and measuring biological samples to serve and support leading-edge biomedicinal studies. Meanwhile, it will open its laboratories to the outside world in hopes to contribute to the nation's hightech development.

The Development of Co-deposition Technique at the Precision Instrument Development Center

The technique of thin-film deposition has registered tremendous progress in the past few years, giving thin film an increasingly important role in a diversity of realms. In application, the quality of a thin film is determined by whether its refraction co-efficient, absorption co-efficient, dielectric constant can meet the changes of frequency and whether its surface coarseness and hardness can meet the requirement. The current materials are more and more unable to meet the application requirement, so the search of process for new materials has become a major task in the development of thin-film deposition technique.

Three years ago, the NSC's Precision Instrument Development Center (PIDC) began to develop, using co-deposition technique, the materials and manufacturing processes for making thin films with adjustable refraction co-efficient. It adopted a computeraided system of dual electron beam gun and dual thickness monitor. The materials it has used include TiO_2 that possesses high refraction co-efficient ranging from about 2.3 to 2.6 and SiO_2 that possesses low co-efficient ranging from 1.46 to 1.48. When deposition is being made, two thickness-monitoring devices are used to control the speed. The PIDC found that adjustable refraction co-efficient can be obtained by employing the different deposition speeds of TiO_2 and SiO_2 to produce different layers of film of different composition. It has used co-evaporation method in the development of films with adjustable co-efficient and in the study of their characteristics. The PIDC has produced films which have refraction co-efficient ranging from 1.46 to 2.6, providing the users with more choices. Besides, due to dope with SiO_2, the structural characteristics of polycrystal as evidenced in the TiO_2 film can become amorphous. This development is meaningful to applications that require scattering because the scattering effect of an amorphous film is much lower than that of a polycrystal film. Therefore, this achievement is very helpful to the application of materials when low scattering or different refraction co-efficient is required.

Two years ago, the PIDC established a continuous laser carbon-dioxide deposition system to develop co-deposition technique for two kinds of material. This system can change the target easily and is applicable to a multitude of materials and, therefore, is versatile. Because it can heat up a single place of the evaporation target, it has made the cooling system unnecessary, making the system easier to erect, operate and maintain. Besides, it can be used in the study of the deposition process and film characteristics of a material. Up to the present, the PIDC has used this system to complete, with much success, the study of co-deposition for TaO_5 and SiO_2, the study of ZnO electro-conductive transparent film by doping it with aluminum, and the study of thermal and illuminating films by doping ZnS, ZnSe and ZrN_2 with zinc (or Er) and the study of GD_2O_2 doped with Eu. It will use the system to study different deposition processes and their characteristics.

In 1995, the PIDC worked out a Multi-target Non-ceplanar RF Sputter System for the development of RF sputter technique. Initially, it selected for the study three materials —$BaTiO_3$, $SrTiO_3$ and $BaxSr_1\text{-}xTiO_3$— which are vital to the process of the next-generation semiconductors. This system is composed of three sputter targets so it can be used in co-deposition for different materials. It is quite flexible and versatile. By varying the deposition speed, it can make $BaxSr_i\text{-}xTiO_2$ films of different compositions for the study of their dielectric characteristics in order to find the process with the highest dielectric constant. After grasping the process and the characteristics of the film, the PIDC will proceed with the application studies and then share the fruits with other institutes and transfer the technology to the industry. Under the plan for opening research to graduate students, the PIDC will recruit students pursuing their master's and doctorate studies to join the research so that it can share its resources with academic circles to maximize the achievement.

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