Preface

After the 4th Asia-Pacific Conference of Electron Microscopy held in Bangkok, a number of well known sceintists in the realm of Application of Electron Microscopy to Materials Science, together with some local speakers, were invited to give tutorial lectures on these topics in a Workshop held in Gaungzhou, China, during August 7-9, 1988. These lectures are certainly of general interest and it was therefore decided to publish them in a monograph.

Electron microscopy has already become a versatile technique to study the composition and structure of materials at the nanometer level. Drs. Zeitler and Howie et al. dealt with the latest development of the electron energy loss spectroscopy and its capability in chemical analysis and imaging. Recently, surface study has attracted the attention of many electron microscopists. In this respect D. Ichinokawa described his ingenious design to incorporate the Auger electron spectroscopy, low energy electron diffraction, and scanning tunneling microscope in his ultra-high-vacuum analytical scanning electron microscope. Drs. Lu, McCartney and Smith, on the other hand, studied the surface structure at atomic resolution by the profile imaging technique. The manuscript prepared by Drs. Guan, Hashimoto and Kuo on the imaging of oxygen atoms in some suboxides, owing to its potential application in the interpretation of the HREM images of oxides to be discussed below, is also included, though Drs. Guan and Hashimoto were regrettably unable to attend this Workshop.

Materials are one of the pillars of modern society and they have recently witnessed a tremendous advancement. First of all, of course, is the discovery of high T_c superconducting oxides whose structures have been elucidated by high resolution electron microscopy and convergent beam electron diffration, as explained by Drs. Fung, and Withers, respectively. In addition to these superconducting oxides, there are many other modulated structures in alloys and oxides and these are discussed in three lectures by Drs. Withers, Yagi et al., and Feng et al., respectively. In a certain sense, quasicrystals with aperiodic translation can also be considered as a special kind of incommensurately modulated structure. The electron diffraction and microscopy evidences of this newly discovered substance were presented by myself and the imperfect quasicrystal by Dr. Li. Dr. Yada presented his recent results of the observation of fission tracks in zirconia by electron microscopy. To show that electron microscopy is not only very useful in metals and oxides, Dr. Dorset gave a comprehensive review of the study of crystal structures of organic compounds, such as paraffins, polymers and lipids, by this powerful method.

Obviously, these tutorial lectures have highlighted the recent important progress in electron microscopy and its application to materials science, and I am fully convinced that this collection of papers will benefit many serious students and research workers as well for many years to come.

Last but not least, I should like to thank the Chinese Academy of Sciences and the International Centre for Theoretical Physics (Trieste) for generous financial support, and also to Mr. J. Zou for his excellent organization of this Workshop.

K.H. Kuo

1. [001] Large angle CBED pattern of *Pb doped* $Bi_2Sr_2Ca_2Cu_3O_{10}$ *superconducting phase.* The 2mm symmetry of the bright field and (020) dark field implies that the point group is *mmm* (courtesy Dr. K.K. Fung).

2. SEM image shows the deca-prism morphology of a *decagonal quasicrystal* while the HREM image gives its periodicity along the 10 fold axis and aperiodicity (Fibonacci series) in the 2 fold direction. The 10 fold ED pattern shows clearly its 10 fold symmetry (Courtesy Ms. C.M. Teng and Mr. L.X. He).