國立清華大學
工程與系統科學系

Electronic thin film Technology

(電子薄膜科技)

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National Tsing Hua University
Department of
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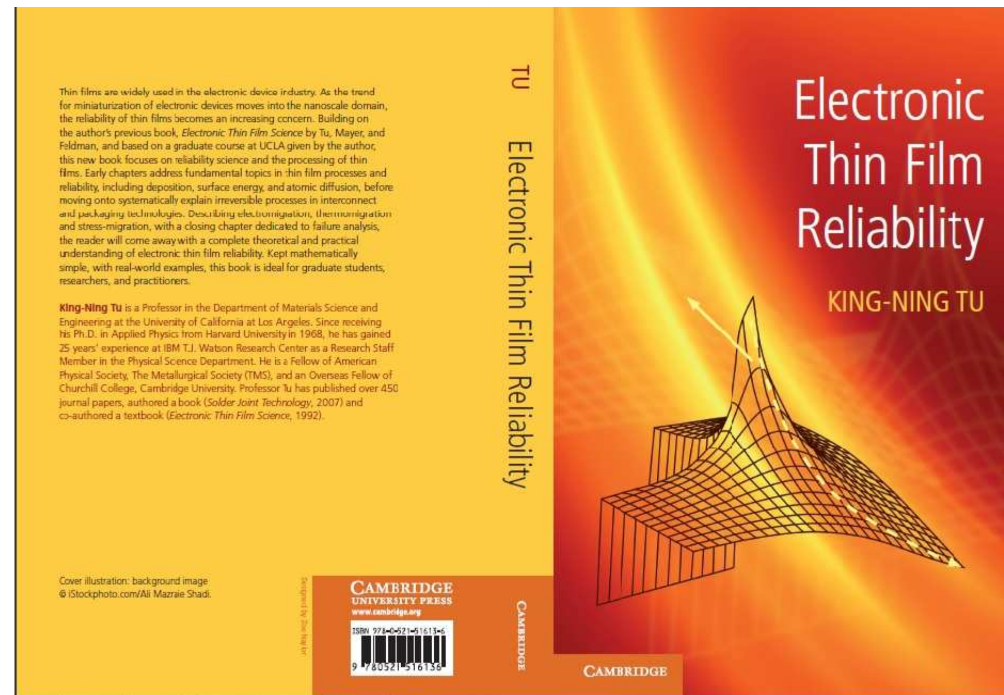
Course Description

It is well known that thin films are widely used in the electronic industry. Due to the trend on miniaturization of electronic devices, nanosclae electronic devices are needed and the technology and reliability of thin films have recently attracted increasing attentions. This course will focuses on the science and process of thin films, and reliability science for thin film application in the electronic industry. The topics will cover:

- Fundamental topic in thin-film process: deposition, surface energy and atomic diffusion
- Application of diffusion equations (Fick's first law and Fick's second law)
- Theoretical and practical understanding of electronic thin-film reliability: Metallurgical reaction, electromigration, thermomigration and stress-migration

Textbook I

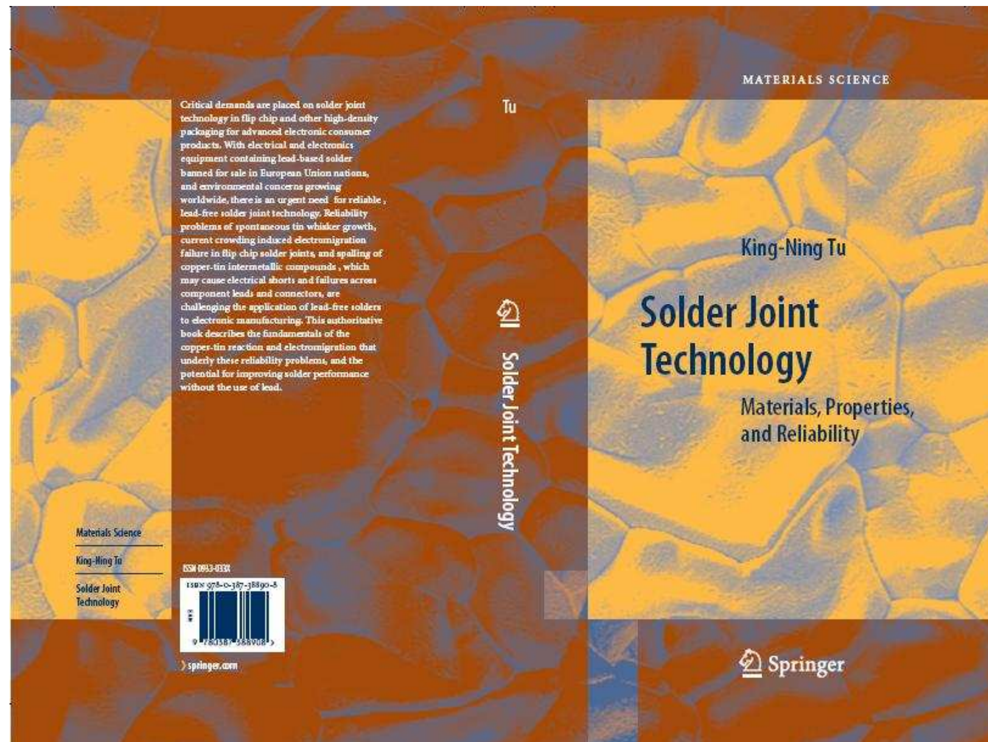
"Electronic Thin-Film Reliability", King-Ning Tu, Cambridge University Press, 2010, ISBN 978-0-521-51613-6.



ESS at NTHU 國立清華大學 工程與系統科學系

Textbook II

“Solder Joint Technology, Materials, properties and reliability", King-Ning Tu, Springer, 2007, ISBN 10:0-387-38890-7.



Reference books

- “Flip chip technologies”John H. Lau, McGraw-Hill, 1996.
- “Electronic Packaging, Design, Materials, Process, and Reliability” John Lau, C.P. Wong, John L. Prince, and Wataru Nakayama, McGraw-Hill.
- “Principles of Electronic Packaging”Donald P. Seraphim, Ronald C. Lasky, Che-yu Li, McGraw-Hill, 1993.
- Fundamentals of Microsystems Packaging, R.R. Tummala, McGraw-Hill, 2001
- 微電子材料與製程，陳力俊主編中國材料科學學會 2000
- “Microelectronics packaging handbook” R.R. Tummala and E.J. Rymaszewski, Van Nostrand Reinhold, 1989.

WEBSITES

Course Website:

LMS數位學習系統
http://lms.nthu.edu.tw/

- Syllabus
- Lecture notes
- Homework problem
- Answer keys

GRADING

Homework 15%

每章約有2~3題作業，兩章交一次作業

Midterm I 30%

Tentatively scheduled for: ww7

Midterm II 30%

Tentatively scheduled for: ww14

Presentation 25%

Tentatively scheduled for: ww15~18

Personal presentation (25 mins)

週次	上課日期	課程進度、內容、主題
1	9/16	Introduction: Thin Film Applications to Microelectronic Technology
2	9/23	Part I: Thin film deposition and Surface energy
3	9/30	Part I: Surface energy & Diffusion in solid
4	10/7	Part I: Application of diffusion equation
5	10/14	Part I: Application of diffusion equation
6	10/21	Part I: Elastic stress & strain in thin film
7	10/28	Midterm I
8	11/4	Part I: Interfacial growth of thin film
9	11/11	Part II: Introduction of reliability, FCT Reliability: Metallurgical Reaction I;

週次	上課日期	課程進度、內容、主題
10	11/18	Part II: Introduction of reliability, FCT Reliability: Metallurgical Reaction II;
11	11/25	Part II: Interconnect Reliability: Electromigration in interconnect
12	12/2	Part II: FCT reliability: Electromigration and thermomigration in FC solder
13	12/9	Part II: Sn whisker (stress migration) and Mechanical stress
14	12/16	Midterm II
15	12/23	Presentation
16	12/30	Presentation
17	1/6	Presentation
18	1/13	Presentation

Class rule

- Be in time to the class.
- The cellular phone should be turned off or in the vibration mode in class.
- No food is allowed in class
- Turn in homework on time. No late homework can be accepted.
- Welcome to stop by my office with questions to the courses