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Silicon Wafer's Sample Thermal Diffusivity Determination Using Nano Flash Equipment

Kevin Bates, Samuel Ibekwe, and Guoqiang Li
Mechanical Engineering Department
Southern University, Baton Rouge

Kun Lian
Center for Advanced Microstructure Devices
Louisiana State University, Baton Rouge

Abstract

Silicon wafer was prepared for thermal diffusivity determination by Nano Flash Equipment. This involved clean room training, designing of masks using Auto Cad, repairing non-functional equipment prior to carrying out the experiment. This challenging and rewarding experience exposed me to what conducting a real research involves. It also gave me the confidence that I can make it in graduate education.

Introduction

Nanoflash LFA 447® is a flash diffusivity instrument which makes thermal properties testing fast, easy and affordable. Thermal diffusivity, conductivity, etc could be easily determined using this equipment. It consists of a Xenon flash lamp used to heat and read sample surfaces, which eliminates thermal resistance and thereby produces accurate measurement of thin samples ~ 3mm. It has a broadband visible and near infrared wavelength with a variable pulse width of 100µs, 400µs and 700µs.

Figure 1. NETZSCH LFA 447® Nanoflash diffusivity instrument

Sample Design and Mask fabrication

Specimen preparation as shown in Figure 2 involved microfabrication using LIGA techniques in a class 100 clean room. However, before the samples could be fabricated, a mask was made, which is like a negative for the optical imprints of the micro-sized specimens.

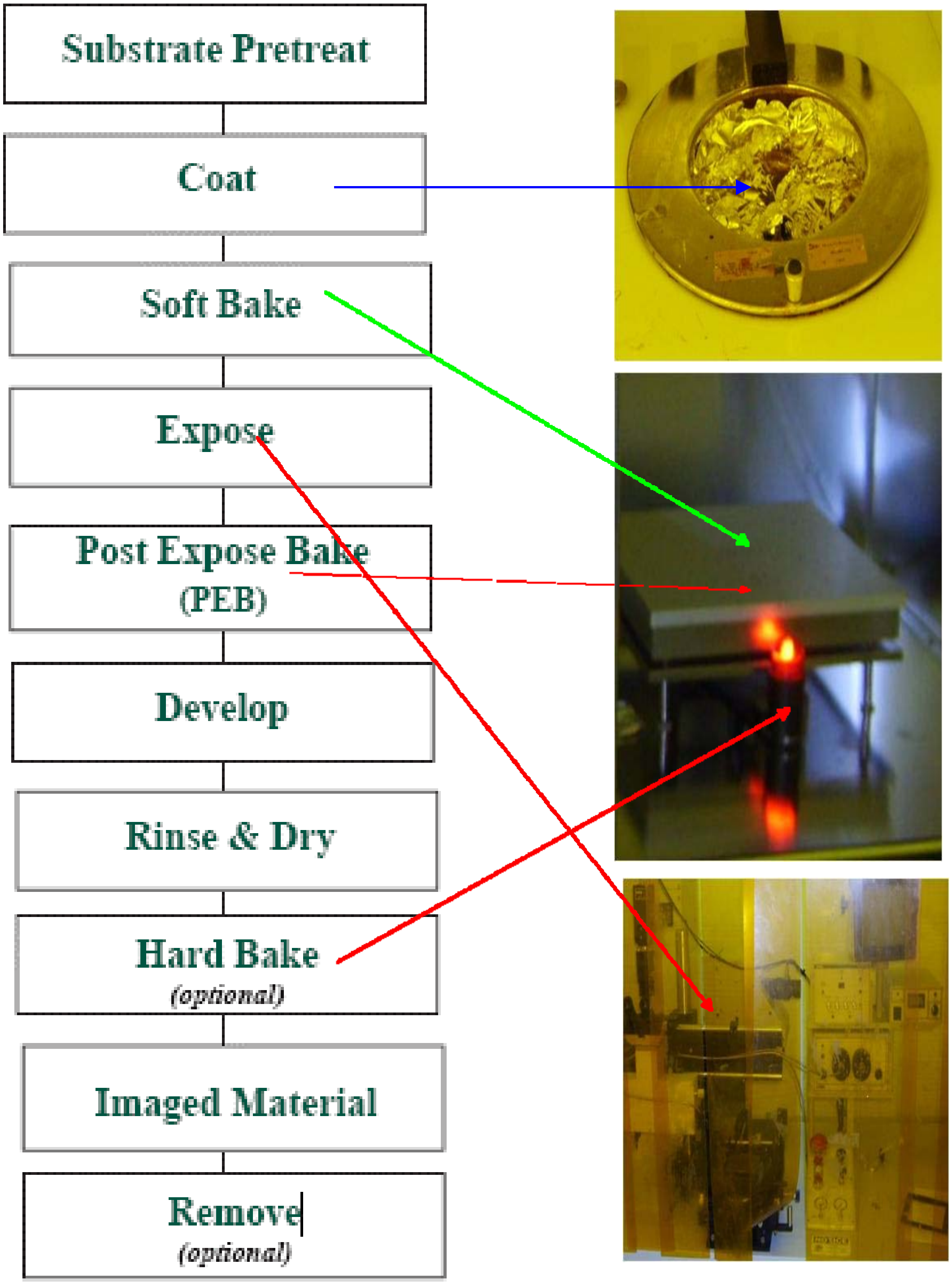

Figure 2. Schematic procedure for sample preparation

Designing the mask started first with a two-hour “clean room” safety training. We were taught procedures for handling specimens safely, and how to conduct ourselves in the laboratory. Use of the equipment was clearly explained to us also by the CAMD personnel. Passing the radiation and clean room test certified me to use the laboratory. The 59.5mm by 59.5mm mask was first designed with AutoCAD® as shown in Figure 3 below. The file was then converted to a binary form to enable the pattern generator read and utilize it. GCA Mann 3600® pattern generator was used to make the mask on a square Cr/Au plate.

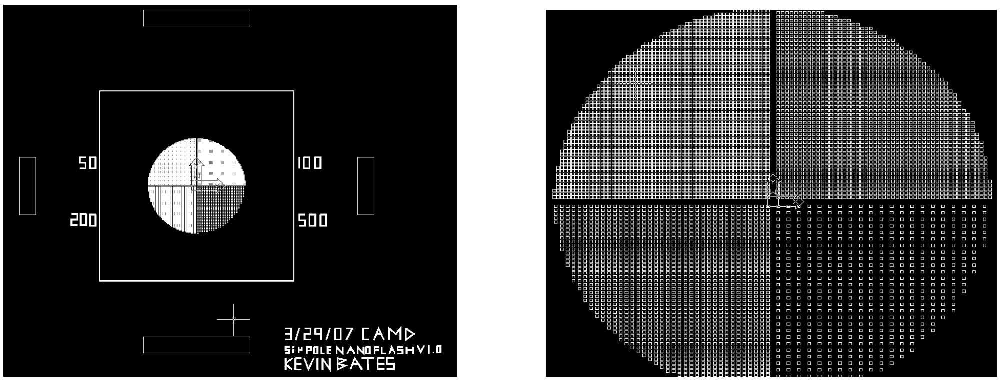

Figure 3. Mask design prior to optical printing of test samples.

The translucent samples were coated with gold layers on both sides. Thereafter a second layer of graphite about 5 microns thick was superimposed on the gold surface. This enhanced the absorption of flash energy, as well as the emission of infrared radiation waves.

Summary and Conclusions

While the sample preparation and tests are on-going, the results will be presented later. It has been a great educational experience for me. This project afforded me the opportunity to work with graduate students and professors in a research setting. My knowledge of computer-aided drafting came in handy, and it was gratifying to see an application of what I learned in a real world setting. Further, the interaction with other team members helped me learn valuable research procedures. Being trained and entrusted with complex laboratory equipment boosted my confidence and aspiration to go for my graduate program.

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KEVIN BATES
Mr. Bates is a senior student at Southern University, Baton Rouge, Louisiana.

SAMUEL IBEKWE, GUOQIANG LI, AND KUN LIAN
Drs. Samuel Ibekwe and Guoqiang Li are professors of Mechanical Engineering at Southern University, Baton Rouge, while Dr. Kun Lian is a professor at Louisiana State University, Baton Rouge, LA, and is affiliated with Center for Advance Micro Devices (CAMD) in Baton Rouge.