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APPLICATION NOTE
 # XE-2011-3112

Quantitative measurements of Ti thin film thickness on wafer and precision study on Ti, V, Cr, Ni, Au and Pt on different glass slides.

ABSTRACT
A calibration curve for measuring Ti thin film thickness on a silicon wafer was established and used for precision measurements. Several repeatability studies were performed on ten thin film coated microscope glass slides and on two thin film coated Si wafers

OBJECTIVE
To calibrate X-CaliburSDD for measurements of Ti and Ni thin film on Si wafers and to show the precision of Xenemetrix X-CaliburSDD EDXRF analyzer equipped with high efficiency SDD detector for thin film measurements on microscope glass slides and on Si wafers.

BACKGROUND
EDXRF is a fast and non-destructive technique that can quantify any type of sample solid, powder or liquid from within a few minutes and can be the method of choice. Energy Dispersive X-ray Fluorescence (EDXRF) spectrometers can play an important role in assuring that consistent quality of samples is retained throughout a manufacturing process.

ANALYTICAL CONFIGURATION
Table 1: Analytical Configuration

Instrument	X-CaliburSDD EDXRF Benchtop Spectrometer System
Anode	Rh-Anode X-ray Tube, 50W
Detector	High Resolution, high flux efficiency SDD detector
Analysis Time	180 second
Type of analysis	Repeatability, Calibration
Sample Preparation	None

EXPERIMENTALS
Repeatability studies were performed on ten thin film coated microscope slides. Acquisition of each slide was done 180 seconds. Ten consecutive acquisitions were performed on each slide without moving the slide between the runs. The results from these precision studies are presented in table 3. The relative precision in % varies between 0.2-1.8

The repeatability results are presented in units of counts in the peaks of elements of interest. In Table 2 is shown a description of the ten different slides with respect to substrate and layers.
Table 3 summarizes the results of the precision measurements in units of counts while Table 4 show the precision result on the Ti and on the Ni wafer in thickness units (Ångstrom).

Table 2: Description of the thin film layers on the microscope slides

3rd layer								Au		
2nd layer	Ni	Au	Au	Au	Au			Pt		
1st layer	Cr	Ti	Ti	Ti	Cr	Ti	Ti	Ti	V	V
Substrate	Si, K, Zn									Si
SLIDE ID	**024**	**L-1**	**L-8**	**L-21**	**Au-05**	**Ti-550**	**Ti(03)**	**P2(03)**	**IBDO**	**CVC**

Table 3: Precision measurements on 10 different slides.
Result reported in measured mean counts ± stand. deviation, relative standard deviation in %.

ID	Ti	V	Cr	Ni	Pt	Au
IBDO90		711,913±1363 rsd=0.19%				
CVC		690,971±2122 rsd=0.31%				
024			715,973±1408 rsd=0.2%	1,056,628±1648 rsd=0.16%		
Ti-550	1,416,416±1400 rsd=0.10%					
Ti(03)	1,290,143±4112 rsd=0.32%					
L-1	24,642±236 rsd=0.96%					76,187±434 rsd=0.57%
L-8	24,014±224 rsd=0.93%					100,487±582 rsd=0.58%
L-21	22,489±248 rsd=1.1%					159,966±322 rsd=0.20%
Au-05			11,809±143 Rsd=1.2			610,254±1607 rsd=0.30%
P2(03)	17,005±295 rsd=1.74%				196,213±1042 rsd=0.53%	274,936±733 rsd=0.27

Table 4: Precision measured on two different wafers. Measured mean thickness±stand.dev., rsd%

Wafer ID/thickness	Ti/thickness, Å	Ni/thickness, Å
Ti_1000/1000 Å	989±1.3; rsd=0.13%	
Ni_1000/1000 Å		1007±4, rsd=0.41%

DISCUSSION

This report shows that for thin film measurements on Si wafers or on slides and in particular for these types of elements investigated here the Xenemetrix X-Calibur SDD EDXRF benchtop analyzer is an excellent choice for good efficiency and high precision results.