

Welcome to the 8th issue of the CAMECA e-newsletter. It is our pleasure to bring you the latest news on instrumental developments, recent partnership projects and innovative applications. We take this opportunity to introduce you to two new CAMECA collaborators: Dan Jacobson is our new Western US Sales Manager, and Curt Scheppmann has been appointed Director of North America Sales and Global APT Marketing.

2012 has been an exciting year, marked with the successful launch of the IMS 7f-Auto secondary ion microprobe, and the strengthening of our SIMS, LEXES, EPMA and Atom Probe user communities. Once more, we wish to thank all our customers and partners for the trust they place in CAMECA.

## LEXES, Atom Probe Tomography (APT)

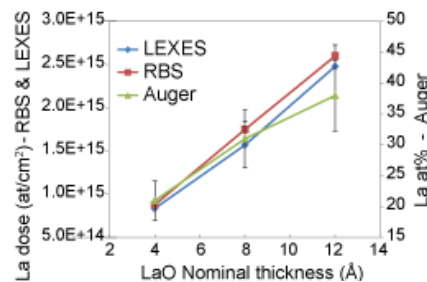
### APT & LEXES TACKLE GATE-FIRST SEMICONDUCTOR PROCESS ISSUES WITHIN EUROPEAN PROJECT



CAMECA is participating in UTTERMOST, a European semiconductor fabrication project aiming at supporting the 28 nm node integration in Europe. STMicroelectronics, Infineon Technologies, Thales, and the LETI form the core consortium. CAMECA is partner with two techniques - Atom Probe Tomography (APT) and Low-energy Electron-induced X-ray Emission Spectrometry (LEXES) which provide complementary analyses of materials used in the gate-first process.

APT has permitted the partners to quantify the sub-nanometer lanthanum diffusion near the HfSiO interface. As an off-line characterization technique, APT enables **compositional quantification at sub-nanometer resolution**, while LEXES enables **in-fab full-wafer compositional metrology**. Unlike other metrology techniques, LEXES can monitor total La dose even if it diffuses towards the interface.

RBS tools are a reference for dose measurements, but they are too large to be used in the fab. Auger sensitivity is sufficient for 4 Ångstrom layers but it is a destructive lab technique. **LEXES proves to be the only accurate, non-destructive technique capable of measuring patterned or blanket wafers even after several processing steps.** Accuracy is shown here for three La doses.



### A REINFORCED LEXES TEAM!

Two new engineers, both PhD in materials science, joined CAMECA last spring to strengthen the LEXES-Shallow Probe team.



Dr Anna Meura (left) has worked on ferroelectric films and several surface

characterization techniques, and Dr Anne-Sophie Robbes (right) has experience in nanocomposite materials development and small-angle X-ray analysis.

Their main activities consist in performing demos and tool acceptance tests, as well as providing application support and on-site training. You might meet them soon at your Shallow Probe site!

## Atom Probe Tomography (APT), EPMA

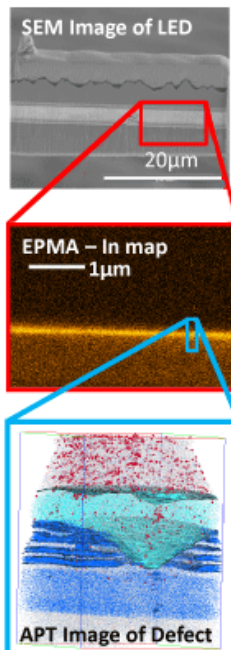
### APT & EPMA ENABLE FAST AND ACCURATE LED ANALYSIS

The 3D, sub-nanometer compositional resolution of APT is unique in analytical microscopy, making it one of the most appropriate techniques for **R&D of complex semiconductor and LED devices**. Analyzed volumes are so small (typically 100 x 100 x 100 nm<sup>3</sup>) that identification of the precise region of interest is critical for minimizing time-to-knowledge.

Recently, a project to analyze real-world semiconductor devices ran directly into this issue: the analysis of the indium quantum well region of a high-brightness LED was slowed due to the ambiguity of the location of the light emission region in the 10 micron thick device.

X-ray mapping by EPMA allows fast and easy identification of the region of interest: the CAMECA **SXFiveFE** Field Emission EPMA was used here to map In **at high lateral resolution**. Subsequent APT analysis with the LEAP 4000 provided the **sub-nanometer 3-dimensional compositional characterization** of the light emitting region, revealing a V-Defect shorting the In quantum wells.

X-ray map acquired on SXFiveFE at 10keV, 25nA.  
APT image shows GaN (grey dots),  
Al (light blue dots), 1% Al concentration surface,  
In (blue dots), 3% In concentration surfaces.



### ATOM PROBE WORKSHOPS... THE WORLD TOUR!

The **European APT Workshop** co-organized last month in Grenoble by CEA Leti and GPM Rouen was a great success! A scientific advisory committee is being settled, looking to organize a similar workshop on a yearly basis, in different European cities. Should you be interested in hosting the next edition within your institution, you are invited to contact Dr Barnes (Leti) or Dr Blavette (GPM).

Shanghai University also hosted the 1st **Chinese LEAP Users Meetings** this month, bringing together nearly 40 participants from a dozen research institutes and universities throughout China.

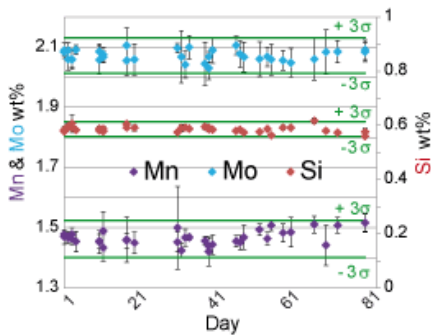
Earlier this year, **APT Users Meeting in the US and India** have been equally well attended, a sign that the community of Atom Probe microscopists is growing fast!

## EPMA: SXFive & SXFiveFE

### LONG TERM STABILITY MEASUREMENTS WITH SXFiveFE FIELD EMISSION EPMA

Newly released stability measurements on the **SXFiveFE** FE EPMA show **superlative repeatability**, a key figure of merit and usefulness for any EPMA data.

#### Stability - Stainless steel: Minor elements



For the data in the image here, not only were the **WDS analyzers NOT recalibrated at all during the 11 week period** of the test, but the test sample was removed from the EPMA inbetween the many successive measurements, in order to free the **SXFiveFE** for other measurements! This **exceptional quality of the SX quantification** is due partly to the fact that the CAMECA **SXFive FE** has a **closed-loop beam current control** (such that beam current has been measured to have standard deviation of only 0.007 nA on a 20 nA beam current over a period of 2 hours, 0.009 nA over 12 hours), but also due to that fact that

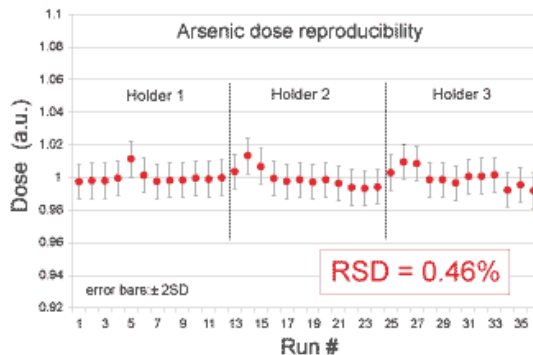
the **CAMECA WDS analyzers have hard-gearred movement with optical encoded feedback**, ensuring that they deliver reliable data.

## SIMS, NanoSIMS

### SIMS ANALYSES WITH ULTIMATE REPRODUCIBILITY AT HIGH THROUGHPUT WITH THE IMS 7f-Auto!

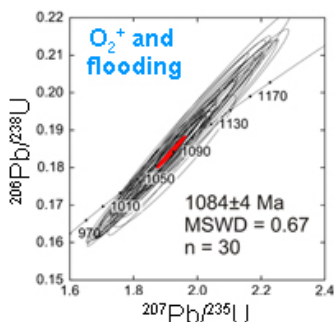
Thanks to its new motorized storage chamber & sample transfer, the **IMS 7f-Auto** can analyze multiple samples in chained or remote mode, possibly overnight. Measurements can be fully unattended and automated, with unequalled throughput and reproducibility.

**Ultimate reproducibility** on different windows and different holders can be achieved (**RSD < 0.5 %**, see above figure), together with **excellent detection limits, high throughput and productivity** (tool can be used 24h a day with minimum operator intervention). More details at [this link](#)!



### INNOVATIVE GEOCHRONOLOGY WITH THE IMS 1280-HR

Recent papers by **IMS 1270 / 1280 / 1280-HR** users report on geochronology studies.



Concordia U-Pb ages for R10b rutile standard, obtained using  $O_2^+$  bombardment with oxygen flooding. Data from A.K. Schmitt and T. Zack, *Chemical Geology* (2012).

In particular, a **pioneering method for rutile (TiO<sub>2</sub>) dating** has just been published by the UCLA group. Indeed, in-situ rutile dating is of increasing interest for the geochronology community. Rutile being conductive under ion beam bombardment, the new protocol consists of  $O_2^+$  primary ions combined with oxygen flooding.  $O_2^+$  offers many advantages: ease of operation, higher overall secondary ion signal (due to the high primary beam intensity) and the reduced common Pb (due to the higher sputter rates) **resulting in precise and accurate rutile dating** as demonstrated on the left.

### NANOSIMS SUPPORTS CHALLENGING EXPERIMENTS IN ENVIRONMENTAL MICROBIOLOGY

### FE-EPMA: NEW APPLICATION NOTE

A new SXFive FE application note is available for: **Quantitative analysis & X-ray mapping at high spatial resolution with FE EPMA**. [Request your copy!](#)

### 19th CAMUS WORKSHOP

The **19th German language EPMA user meeting** was hosted at our Gennevilliers headquarters last October 3-5. Co-organized by CAMECA and Dr Hans-Peter Meyer of Heidelberg University, this 19th "CAMUS workshop" gathered nearly 30 electron microprobe experts from Germany and Austria. The participants presented their latest research projects and discussed applications and methods. A demo of our SXFiveFE Field Emission microprobe was also on the agenda.

### ACCURATE USJ PROFILING WITH EXLIE SIMS

The CAMECA EXLIE SIMS ion microprobes are now recognized as the best suited tools for characterizing ultra-shallow implants. Interesting results obtained on a CAMECA **SC Ultra** were published last August in an article by VSEA/Applied Materials researchers D. Kouzminov, E. Arevalo and H.J. Grossman and CAMECA EXLIE SIMS specialist A. Merkulov. You may [request a copy](#) of "**Application of extra-low impact energy SIMS and data reduction algorithm to USJ profiling**", *Surf. & Interface Analysis*, 5 Aug. 2012.

### WELCOME TO OUR NEW SIMS & NanoSIMS USERS!

We are very proud to welcome **Arcelor Mittal**, one of the world's leading steel and mining companies among our **IMS 7f** user community. Installed at the Maizieres R&D center in France, the tool will contribute to the development of innovating steel products and solutions. The **Gangzhou Institute of Geochemistry**, one of the top Chinese research institutions in earth and environmental sciences has selected our **IMS 1280-HR** to support multiple research projects in continental dynamics and lithospheric evolution, marine geology, environmental pollution and sustainable development... **IPREM**, a multidisciplinary institute within University of Pau, France has chosen our **NanoSIMS 50L** for its **MARSS** platform (Center for MASS Spectrometry for Reactivity and Speciation Sciences). The system is funded by "Equipex-Investment for the Future" program and will serve a broad range of projects in material and environmental sciences.

### NanoSIMS UPGRADES

We are proud to mention a recent scientific environmental microbiology article in **Science**: Unicellular Cyanobacterium Symbiotic with a Single-Celled Eukaryotic Alga, by Anne W. Thompson, Rachel A. Foster et al. Science, Sept. 21st, 2012, VOL 337.

The **NanoSIMS 50L** of Max Plank Institute Bremen, Germany was used to measure and image a mutualistic partnership between an alga fixing carbon and exchanging it against nitrogen fixed by a cyanobacterium.

After incubation with rare isotopes (here  $^{15}\text{N}_2$  and  $^{13}\text{C}$ -bicarbonate) under in-situ conditions, **isotopic ratios were measured quantitatively with high lateral and mass resolution** in the NanoSIMS, imaging and quantifying the interactions between cells or organisms.

**A new catalogue of upgrades is available for the NanoSIMS.** Among the numerous items: improved optical microscope system, Ultra Low Energy pre-implantation, duplication of the control station, PC upgrade with point logger, 32bit acquisition board, instrument control through internet, and higher maximum primary current column usually for use with Faraday Cups.

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