

November 2005

■ Welcome

to the first Newsletter from aixACCT Systems, your partner for electrical testing, material development and device qualification.

New materials are conquering the market at a breathtaking pace.

Engines are being fitted with ceramic injection systems. Semiconductors store information permanently without electrical voltage. The flow of ink in inkjet printers is controlled using piezoelectric thin-films. In many industries, the materials of tomorrow are today already a reality. But we are only at the beginning of the development – the future is full of inexhaustible opportunities and possibilities.



With its know-how in material testing, aixACCT systems is at the leading edge of development.

We offer new testing concepts and customer oriented solutions for test systems. This enables our clients to reduce the time from development to market.

With the aixACCT Systems Newsletter we will give you valuable insights into the world of sensors, actuators, micro-electromechanical systems and ferroelectric memory. We will present quarterly information on the latest developments and solutions in electromechanical testing. Get informed about our products and services and how they are being used! Don't miss out on the latest news and important aixACCT events!

Happy reading!

Yours sincerely,
Stephan Tiedke

■ AixACCT Systems is a Leading Player



AixACCT Systems is an experienced company with an international reputation in the semiconductor industry, sensor metrology and material research.

"The innovations, patents and application oriented publications underline aixACCT's position as a leading player with enormous potential."

(Prof. Rainer Waser, Electronic Materials Research Lab, RWTH Aachen, Forschungszentrum Jülich)

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■ aixACCT and INOSTEK Form Strategic Partnership

aixACCT Systems GmbH and the Korean technology provider, INOSTEK Inc, became partners for thin-film products and material testing in September. Thin-film technology is the key to producing ferroelectric memory (FeRAM) that stores information permanently without electrical voltage.

The production of micro-electromechanical systems (MEMS) is only possible thanks to thin-film technology. Stephan Tiedke, president of aixACCT, sees the partnership as an engine for new developments: "We cover the entire supply chain, from the delivery of material to testing components and products that are ready for sale. This makes the new technology more attractive for the market."

INOSTEK is the world's leading supplier of the sol-gel solutions and the customized thin-films for ferro-, pyro- and piezoelectric applications. In recognition of its work, the company was awarded the title "National Research Laboratory" (NRL) in 2001 by the Korean Ministry of Science and Technology. In coating ultra-thin ferroelectric layers with material such as lead zirconium titanate (PZT), INOSTEK has developed a chemical process that is necessary for the development of non-volatile ferroelectric universal memories as a mass product. This process also opens up new possibilities for the MEMS industry.

As a leader in innovative concepts for measuring the electrical properties of materials, aixACCT systems has significantly reduced the time from the development of a new product to its market introduction. The material tests are therefore of fundamental importance for manufacturers and users of the new materials. The tests enable feasibility studies and ensure the highest levels of quality through the assignment of material and product characteristics. In addition, aixACCT Systems supplies the appropriate measuring system: from devices and components for analysis as well as a specimen holder for reliably measuring piezoelectric thin-films, to software for statistical analysis and documenting the production.

aixACCT Systems is a well-established partner for material development departments. Through its partnership with INOSTEK, the company gains even greater significance.



■ Technology and Product Worlds on the new aixACCT Website

aixACCT systems has a new website. The "Technology World" offers a look at the thin-films and memories, micro-electromechanical systems (MEMS) and the sensors and actuators.

The enormous potential in the semiconductor industry, sensor technology and material research is clear to see. "Product World" shows the performance and specifications of aixACCT products. Since October, customers, interested parties and partners have been able to find out the latest news about the Aachen based company. Visit the new website at www.aixacct.com.

November 2005

■ First Electrical Measurement on a Wafer of the Demonstrator Generation

aixACCT Systems GmbH proves its expertise in electrical testing of thin-film technology with the tests on the wafer of the demonstrator generation.



The partners in the European MEMS-PIE project (Integration of piezoelectric thin films in micro-electromechanical systems) met from 22 to 23 September at aixACCT Systems in Aachen, Germany in order to exchange interim results. Stephan Tiedke (president) and Klaus Prume (project manager) presented the technical possibilities of electrical measuring.

In the MEMS-PIE project assured processes were developed for integrating piezoelectric thin-films in micro-electromechanical systems (MEMS) in industrial applications. Having started in the Autumn of 2004 and scheduled to run until the middle of 2006, the project aims towards open, free and above all cost-effective MEMS production. This is particularly relevant for small and middle-sized businesses that don't have the resources to establish their own production plants.

The MEMS technology is decisive for the development of new types of sensors and actuators based on the latest silicon technology with integrated piezoelectric functions.

Partners on the project are, along with aixACCT, EPFL-Laboratoire de Céramique (Switzerland), Hök Instruments AB (Sweden), IMS der Universität Twente (Netherlands), Noliac A/S (Denmark), Precision Acoustics Ltd. (England), Sintef (Norway) and Sonitor Technologies AS (Norway).

The next meeting, again in cooperation with aixACCT Systems, will take place in Lillehammer, Norway in March 2006.

■ 4-Point Bending Sample Holder Filed for a Patent

A special sample holder, which was developed by aixACCT Systems and the Swiss Laboratoire de Céramique (EPFL), was filed for a patent in February 2005.

It allows the application of a well defined excitation strain to the sample in micro-electromechanical systems (MEMS) technology. Utilizing a 4-point bending setup, aixACCT Systems introduces a new innovative method to characterize piezoelectric thin-films.

In combination with a single or a double beam laser interferometer this setup allows the determination of the effective transverse and longitudinal piezoelectric coefficients $e_{31,f}$ and $d_{33,f}$ respectively.

The combination of silicon wafer processing and piezoelectric thin-film technology has led to a variety of miniaturized sensors and actuators. These MEMS utilizing either the longitudinal piezoelectric coefficient, e.g. in pressure sensors, or the transversal piezoelectric coefficient, which is exploited mostly in bending structures like cantilevers, membranes, and micro-switches. The knowledge of electrical and piezoelectric properties of the thin film structures on substrates is crucial for the development, design, and process qualification of MEMS.

November 2005

Recent Publications

F. Peter, A. Rüdiger, R. Dittmann, R. Waser, K. Szot, B. Reichenberg, K. Prume: Analysis of shape effects on the piezoresponse in ferroelectric nanograins with and without adsorbates. *Appl. Phys. Lett.*, 87(8):082901 (2005)

B. Reichenberg, S. Tiedke, K. Szot, F. Peter, R. Waser, S. Tappe, T. Schneller: Contact mode potentiometric measurements with an atomic force microscope on high resistive perovskite thin films, *J. Europ. Ceram. Soc.*, 25, 2353 - 2356 (2005)

R. Meyer, S. Tiedke, T. Schmitz, K. Prume: Dynamic leakage current compensation in ferroelectric thin film capacitor structures, *Appl. Phys. Lett.*, 86, 142907 (2005)

Recent Presentations

S. Tiedke, T. Schmitz, C. Pithan, D. Hennings: Electrical Characterization of Electroceramics in View of Nanograin Materials, Japanese-German Workshop on Nanocrystalline Dielectrics and Their Application, Niigata, May 20th, 2005

S. Tiedke, T. Schmitz, K. Prume: Nanoscale Electrical Characterization of Ferroelectrics, Sino-German Workshop, Xi'an, March 5th, 2005

K. Prume, P. Gerber, C. Kügeler, U. Böttger, R. Waser, T. Schmitz and S. Tiedke: Substrate And Structure Dependencies Of The Effective Piezoelectric Coefficient ($d_{33,eff}$) Of PZT Thin Films: Simulations And Measurements, poster presentation at ISIF Shanghai, April 17-20, 2005

T. Schmitz, R. Bruchhaus, G. Beitel, and S. Tiedke: Monitoring The Switching Process Of Ferroelectric Memory Cell Capacitors Of A 32Mb Chain FeRAM, presentation at ISIF Shanghai, April 17-20, 2005

aixACCT Calendar of Events

November 29 – December 1

MRS Fall Meeting: Meet aixACCT at the MRS Exhibition (Material Research Society), Boston, USA, Exhibition booth No. 932

<http://lucy.mrs.org/meetings/fall2005/>

March 6 - 8, 2006

Polecer meeting Piezoceramics for end-users II – From electroactive materials to multifunctional integrated devices, Hafjell, Lillehammer, Norway

<http://www.sintef.no/piezo2006>

April 23 - 27, 2006

ISIF 2006, International Symposium on Integrated Ferroelectrics, Honolulu, Hawaii

<http://www.isif.net>

May 24 - 27, 2006

23rd Meeting on Ferroelectric Materials and Their Applications, Kyoto, Japan

<http://fma.naist.jp/>

June 14 -16 2006

ACTUATOR 2006 - 10th International Conference on New Actuators and 4th International Exhibition on Smart Actuators and Drive Systems, Convention Center Bremen, Germany

<http://www.actuator.de>