

Monday 2nd August

Dear Colleague

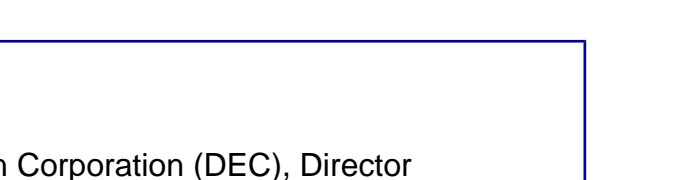
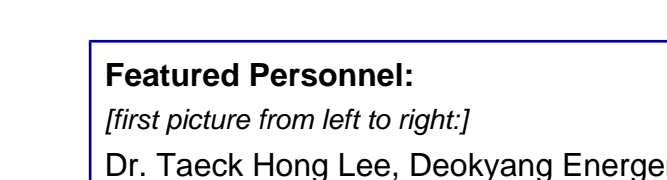
Welcome to our latest electronic edition of Epichem News. We invite you to forward this message to any interested parties at your workplace and encourage them to sign up to receive a copy directly in the future.

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Epichem Gases Expands in Korea

Epichem's joint venture with Degussa to bring an enhanced range of silane based chemicals to the market place continues to expand. The collaboration brings together in-depth product knowledge, including a large portfolio of silanes, and comprehensive market knowledge of the semiconductor and related industries. It is the vision of both Epichem and Degussa to maintain a leading technological edge by innovative strength and a combined market and customer focus. To service this growing area a new agent in Korea has been appointed They are Deokyang Energen Corporation (DEC) and personnel from DEC are seen pictured here with Epichem and Degussa representatives prior to the official signing ceremony. DEC is a well established gas supplier with many years of experience in the industry and this new partnership will enhance customer relations by extending local servicing to ensure customer requirements are met to the highest standard. The products offered at this time include Dichlorosilane (DCS), Trichlorosilane (TCS), Hexamethyldisilazane (HMDS) and Tetraethoxysilane (TEOS) with more products being brought through our stringent development programs for introduction in the near future.



DEC, Epichem and Degussa personnel at the official signing ceremonies

Featured Personnel:
[first picture from left to right:]
 Dr. Taeck Hong Lee, Deokyang Energen Corporation (DEC), Director
 Hung Sun Kim, Deokyang Energen Corporation (DEC), Vice President
 Chi-Yoon Lee, Deokyang Energen Corporation (DEC), Vice President
 Dr. Harald Metz, Degussa AG
 Dr. Peter Heys, Epichem Group, Gases Director
 Les Birt, Epichem Group, Finance Director
 Brian Williams, Epichem Group, New Business Director
 John Selby, Epichem Group, Sales Director
 Tony Pickford, Epichem Group, Health & Safety Manager

[second picture from left to right:]
 Dr. Taeck Hong Lee, Deokyang Energen Corporation (DEC), Director
 Dr. Reinhold Stork, Degussa AG, Production Manager - Chlorosilanes
 Hung Sun Kim, Deokyang Energen Corporation (DEC), Vice President
 Chi-Yoon Lee, Deokyang Energen Corporation (DEC), Vice President
 Dr. Peter Heys, Epichem Group, Gases Director
 Dr. Harald Klein, Degussa AG, Director - Sales & Marketing, Electronic Materials
 Dr. Klaus Krieger, Degussa AG, Quality Manager

Epichem (Shanghai) Chemical Co Ltd is formed



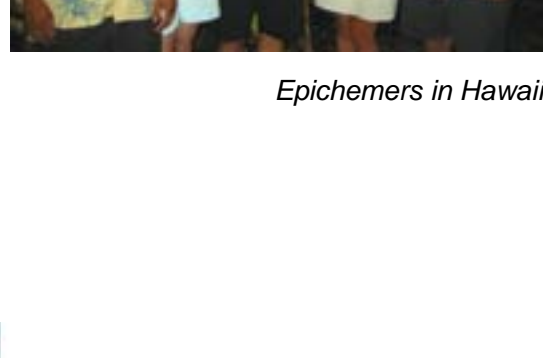
In order to optimise support for all its product ranges in China Epichem is pleased to announce the formation of Epichem Shanghai. On 1st July the highly successful partnership with UVI ended and direct contact between Epichem personnel and the customers was provided through the primary contact at Epichem Shanghai, Shufan Cheng. Technical support and sales activities have all been transferred smoothly and the Epichem commitment to its customers to provide local support, the best products, services and technology possible has been enhanced. Key products such as silane and metalorganics are available for immediate delivery from our own local warehouse in Shanghai.

Shufan Cheng

Conference reviews

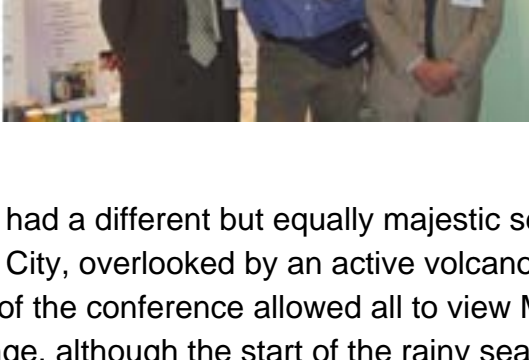
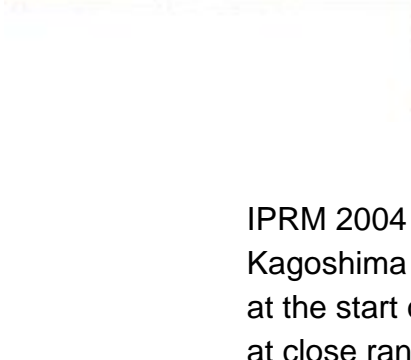
Two major compound semiconductor conferences were held in June in the same week making Epichem personnel choose between Hawaii and Japan as picturesque locations.

ICMOVPE XII was hosted on Maui and the 350 delegates in attendance were treated to stimulating technical presentations and exciting relaxation activities. The LED related topics were to the fore with devices for lighting applications showing good progress whilst ZnO deposition and Mn based spintronic devices were also identified as growing areas. Delivery systems for larger quantities of organometallics and product level monitoring were presented with Epichem leading the way with its EpiFill™ and EpiSensor™ equipment. On the social agenda, Epichem laid on an evening event at the Hula Grill and all enjoyed this informal get together. Entering into the local spirit the Epichem team were dressed in 'traditional' outfits to be clearly recognised.



Epichemers in Hawaii

The stand at ICMOVPE XII



The stand at IPRM 2004

IPRM 2004 had a different but equally majestic setting in Kagoshima City, overlooked by an active volcano. A boat trip at the start of the conference allowed all to view Mt Sakurajima at close range, although the start of the rainy season restricted sightseeing a little. Again a highly interesting technical program ensured lively debate and Epichem's latest research results were well received. A topic widely featured at IPRM was the increased study of a variety of materials systems involving As, Sb and N compounds and their integration with InP based systems. Also presented was a session dedicated to photonic crystals with a focus on improved waveguiding, faster switching and use in tuneable lasers for multiplexing units. In particular, details of a new bubbler design for Solid TMI were presented at the conferences along with SBT deposition and vapour pressure measurement activities. The conclusion by all was that Epichem continues to provide an excellent combination of technical and social support to its customers.



Kagoshima boat trip

TMA for ALD applications

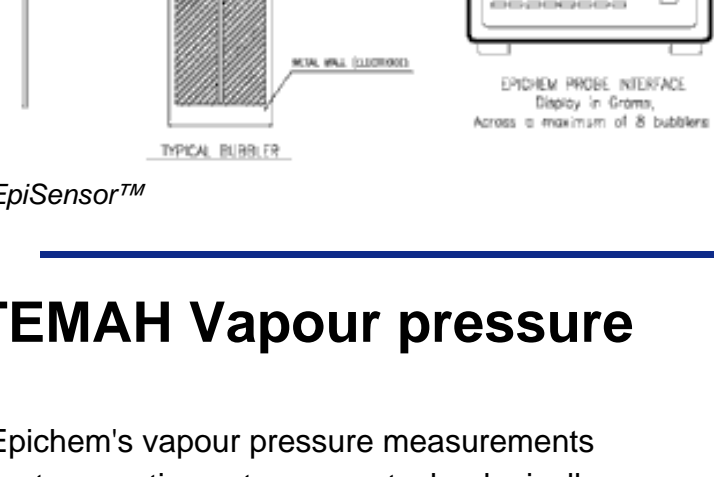
As the semiconductor market continues to advance new materials are being introduced to the production environment and the fastest take up to date is Al₂O₃. The favoured deposition method is to use Trimethylaluminium (TMA) and water in an ALD process. (see ALD process description latter in this newsletter). Delivery of this pyrophoric material to the tool requires specialised equipment as any contamination or removal is highly hazardous and Epichem has used its extensive experience to develop bulk delivery options for this product. EpiFill™ and EpiSensor™ systems allow controlled usage and monitoring of larger scale volumes of TMA in a safe and accurate manner.



EpiFill™



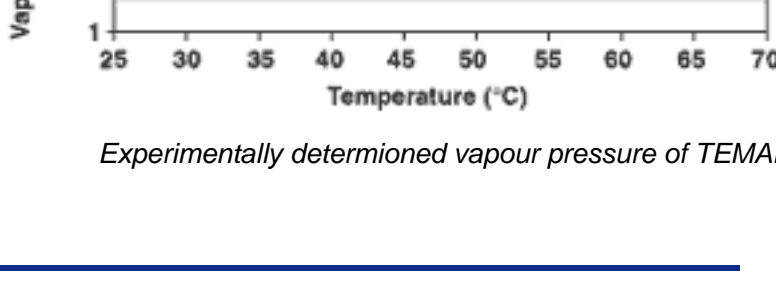
Bulk bubbler



EpiSensor™

TEMAH Vapour pressure

Epichem's vapour pressure measurement system continues to assess technologically important precursors to provide accurate data on an increasing range of products. The latest compound to be studied was tetrakis(ethylmethlamido)hafnium (TEMAH, Hf(NEtMe)₄) and the vapour pressure graph is shown here. Epichem will continue to use its proprietary equipment to ensure customer relevant data can be provided as part of our technical support service.



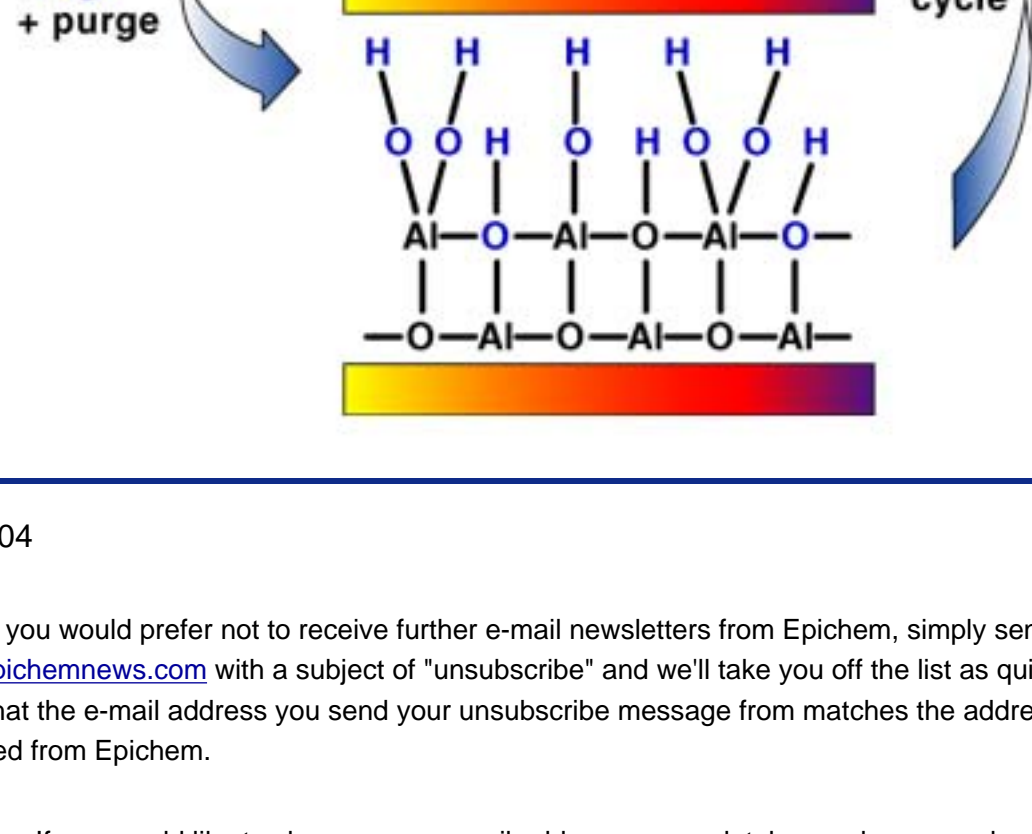
Experimentally determined vapour pressure of TEMAH

ALD precursor requirements

Because ALD relies on chemical reactivity and not thermal decomposition there are fundamental differences in the characteristics desirable for a suitable precursor. The source should be volatile to allow efficient transport to the deposition site and it must be thermally stable at the growth temperatures employed. A fast and complete chemical reaction is necessary between the metal source and the oxide or nitride source, however this reaction should only take place at the exposed surface and not penetrate to etch or damage the underlying structure. The reaction byproducts must be readily removed from the surface to the exhaust and ideally be non hazardous to the environment. Similarly the product should be easy and cheap to manufacture to very high purity in a safe and environmentally friendly manner. An excellent example of such a precursor system is TMA and H₂O hence the development of Al₂O₃ deposition by ALD has progressed significantly and enjoys increasing use in production processes.

Atomic Layer Deposition (ALD)

ALD is a thin film deposition technique based on supplying individual chemicals in the gas phase to the substrate surface in an alternating fashion and relying on the precursor reactivity to control the growth process. Each cycle of precursor introduction yields a saturated surface that self limits the growth until the next precursor introduction is performed and this repetition and control is shown in the diagram below. This results in a number of advantages such as excellent conformality and uniformity and simple, accurate film thickness control. However ALD also suffers from slow deposition rates since at best one monolayer is grown during each cycle. The decrease in layer thickness in future semiconductor devices this limitation is becoming less of a barrier to its widespread adoption as the preferred deposition technique for advanced, complex layer structures.



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