On the history of ALD and the VPHA project

Riikka L. Puurunen,1 Yury Koshtyal,2 Henrik Pedersen,3 J. Ruud van Ommen,4 Oksana Yurkevich,5 Jonas Sundqvist6

1 VTT Research Centre of Finland Ltd, Espoo, Finland
2 Ioffe Institute, St. Petersburg, Russia
3 Linköping University, Linköping, Sweden
4 Delft University of Technology, Delft, the Netherlands
5 Immanuel Kant Baltic Federal University, Kaliningrad, Russia
6 Lund University, Lund, Sweden; and The Fraunhofer IKTS, Dresden, Germany
E-mail: riikka.puurunen@vtt.fi

Atomic Layer Deposition (ALD), based on the repeated, self-terminating gas—solid reactions of at least two gaseous compounds on a solid substrate, has become a disruptive key enabling materials manufacturing method. By its inventors, this method was given the name Molecular Layering (1960s, Soviet Union) and Atomic Layer Epitaxy (1970s, Finland). While the original names still live on, gradually since the 1990s, “ALD” has evolved to be the mostly commonly used name for the technique.

Virtual Project on the History of ALD (VPHA) was set up in summer 2013 as an open effort, in which volunteered scientists from all around the world work together in an atmosphere of openness, respect and trust to better understand the early days of ALD (“early” is defined here to end in 1986). VPHA has already resulted in joint publications, a tutorial, two essays, an exhibition, Wikipedia updates, and a blog; see http://vpha-ald.com and VPHA publication plan for details.

This presentation at the 14th International Baltic Conference on Atomic Layer Deposition aims to be the last organizational talk of VPHA. The presentation has two goals. First, it will overview of the activities and results of VPHA. Second, it will---on the basis of the new big picture developed in VPHA---summarize the major steps of advancement, which have taken place in the early research and technology of ALD around the world.

Acknowledgement: We are grateful to Tuomo Suntola, Anatoly Malygin and Victor Drozd their general support during the VPHA, to Aziz Abdulagatov and Annina Titoff for help in initiating the VPHA, and to Angel Yanguas-Guil for help with creating and updating ALD-related Wikipedia pages. We kindly thank all participants of VPHA who (as of June 15, 2016) have shared comments in the ALD-history-evolving-file (in alphabetical order): Jaan Aarik, Esko Ahvenniemi, Andrew Akbashev, Saima Ali, Mikhail Bechelany, Maria Berdova, David Cameron, Nikolai Chekurov, Mikhail Chubarov, Véronique Cremers, Victor E. Drozd, Simon D. Elliott, Liliya Elnikova, Gloria Gottardi, Kestutis Grigoras, Dennis Hausmann, Cheol Seong Hwang, Shih-Hui Jen, Marcel Junige, Tanja Kallio, Jaana Kanervo, Ivan Khmelnitskiy, Do Han Kim, Lev Klibanov, Outi Krause, Jakob Kuhns, Irina Kärkkänen, Marja-Leena Kääriäinen, Tommi O. Kääriäinen, Luca Lamagna, Adam Lapicki, Markku Leskelä, Harri Lipsanen, Jussi Lyytinen, Anatoli Malkov, Anatoliy Malygin, Christian Militzer, Jyrki Molarius, Małgorzata Norek, Cagla Ozgur-Akgun, Mikhail Panov, Luis Fabián Peña, Fabien Piallat, Georgi Popov, Alexander Pyymaki Perros, Geert Rampelberg, Robin H. A. Ras, Erwan Rauwel, Fred Roozeboom, Timo Sajavaara, Hossein Salami, Hele Savin, Nathanaelle Schneider, Thomas E. Seidel, Pia Sundberg, Dmitry Suyatin, Massimo Tallarida, Tobias Törndahl, Mikko Utriainen, Thomas Waechtler, Claudia Wiemer, and Oili M. E. Ylivaara. RLP acknowledges partial funding from the Finnish Centre of Excellence in Atomic Layer Deposition by the Academy of Finland.