Current and Emerging ALD Processes, Precursors and Applications in High Volume Production

Dr. Jonas Sundqvist
[1]*Fraunhofer IKTS, Dresden*

jonas.sundqvist@ikts.fraunhofer.de

Atomic Layer Deposition (ALD) is used to deposit conformal thin films with sub-nm film thickness control. The method is unique in the sense that it employs sequential self-limiting surface reactions for growth in the monolayer thickness regime. In a European context ALD was invented independently twice in Europe (Russia & Finland) and since the last 20 years Germany has grown to become one of the strongest European markets for ALD in R&D, chemicals, equipment and end users.

Today, ALD is a key global technology in leading semiconductor technology and the field of application in other leading-edge industries is increasing rapidly. According to market estimates the equipment market alone is currently at an annual revenue of approaching US$ two billion (2018) and it is expected to double in the next 4-5 years showing double digit CAGR.

Having been extensively studied over three decades for the replacement of silicon dioxide (SiO2) in conventional semiconductor fabrication, ALD Hafnium Oxide (HfO2) among other high-k dielectrics was finally adopted by Samsung in 2004 in high volume manufacturing at the 90 nm DRAM node as the high-k capacitor dielectric. The other DRAM companies followed, and later in 2007 Intel introduced ALD HfO2 at the 45 nm node as high-k gate dielectric. These events lead to a boom in ALD equipment and precursor market, which was followed by additional processes, precursors, materials and applications for ALD in the semiconductor industry.

The presentation will focus on the current markets for ALD and addresses the applications in semiconductor industry, MEMS & Sensors, Battery Technology, Medical, Display, Lightning, Barriers and Photovoltaics.