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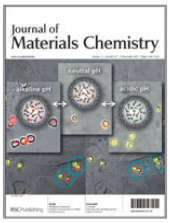

Hot paper: Atomic layer deposition of polyimide thin films

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Matti Putkonen, currently working at Beneq Oy in Vantaa, Finland, explains the significance of and motivation behind his recent *Journal of Materials Chemistry* hot paper.

Could you explain the significance of your article to the non-specialist?

Atomic layer deposition (ALD) has traditionally been used for the deposition of inorganic materials, such as metals as well as metal oxides, nitrides and sulfides. Polyimide thin films are attractive materials due to their resistance towards high temperatures, mechanical stress and various chemicals. We have demonstrated surface-controlled ALD-type growth of several polyimide thin films at 160 °C. Surface reactions between these precursors produce water that can be easily removed under reduced pressure during the ALD cycling. Therefore ALD processed polyimide thin films do not need post-deposition imidisation treatments at elevated temperatures that could lead to film cracking. Based on the present study, ALD may offer a conformal method to produce polyimide thin films for future microelectronics and especially MEMS devices.

What has motivated you to conduct this work?

The ALD research group at the Helsinki University of Technology (TKK), the Laboratory of Inorganic and Analytical Chemistry, has over 20 years of experience in ALD technology. During the past 10 years or so the focus has been on oxide materials needed for microelectronic and other devices, for example, high-k dielectrics or materials for gas sensors. A continuing research has been maintained to develop and test new precursors for important inorganic film materials. However, ALD has been studied only a limited extent for the deposition of the polymer thin films. We have previously demonstrated that both dianhydride and diamine precursors can attach to the high-surface area silica in a self-limiting manner. This observation and the expertise gained over the years prompted us to combine ALD technology with the existing volatile precursors, in order to develop an ALD process for polyimide thin films.

Where do you see this work developing in the future?

Based on the success of the present work, the properties of polyimide thin films can be tailored, since there is wide selection of different functional diamines and dianhydrides. In addition, ALD deposition of organic-inorganic hybrid materials should be feasible.

"ALD has been studied only a limited extent for the deposition of the polymer thin films"

Are there any particular challenges facing future research in this area?

Depending on the precursors employed, the problems to overcome include: low film growth rate, poor precursor thermal stability and film impurity levels. In particular, since ALD is based on self-limiting reactions without precursor condensation, the volatility of bulky precursors, such as those containing large side-groups or heteroatoms, may introduce additional challenges.

Atomic layer deposition of polyimide thin films

Matti Putkonen, Jenni Harjuoja, Timo Sajavaara and Lauri Niinistö, *J. Mater. Chem.*, 2007, **17**, 664
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