Chemical Surface Functionalisations of 3-Dimensional Structured Microstructures

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Introduction:

The production of customized three-dimensional structures in the micrometer range by the micromachining technology is only relatively short time possible.

An essential aspect for applications of this technology in microoptics, micromechanics, microelectronics and microchemistry is the possibility to modify their inner surfaces.[1-3] Such modifications often require the introduction of metals or metal components into such microsystems for many applications.

The Chemical Vapour Deposition of Organometallic compounds (OMCVD) allows the deposition of metals from the gas phase, without the damaging of these often highly temperature-sensitive microstructured substrates.

Figure 1 shows the different steps during the OMCVD-process:

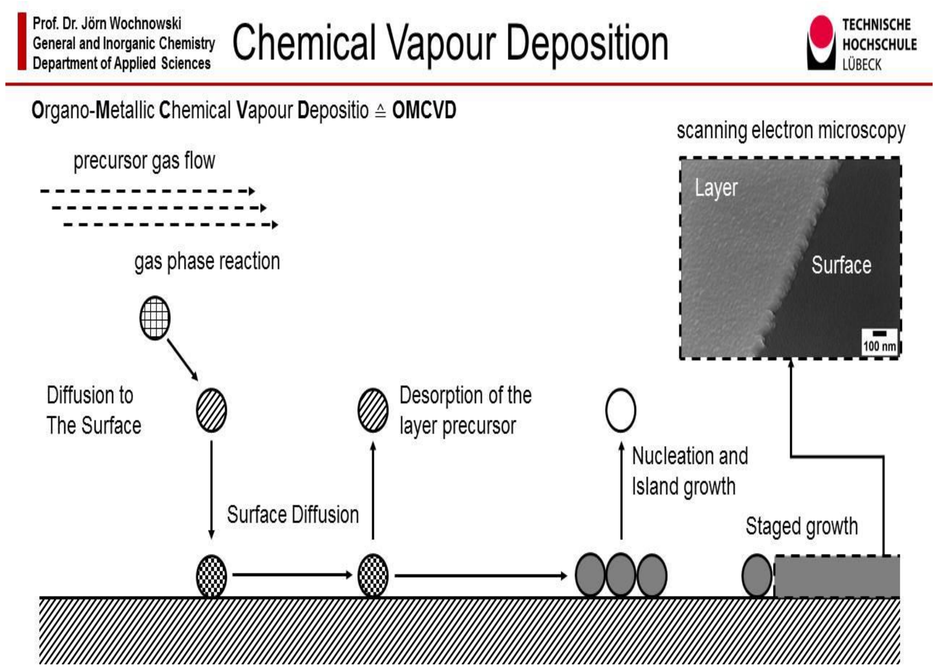

Figure 1: Schematic of the OMCVD-process

Literature:

[1] J. Wochnowski et al., Hollow waveguide used in medicine and in structural analysis comprises a channel structure having an inner coating with a specified thickness
Patents: DE 102007049929 (A1) 2009-04-23; DE200710049929 20071018; DE 102007049929 (B4) 2011-05-05

[2] J. Wochnowski et al., Surface-modified structures, useful e.g. in optical or catalytic applications, comprise substrate, e.g. of glass, silicate primary coating and secondary coating, e.g. of metal
Patents: DE 102007049930 (A1) 2009-04-23; DE200710049930 20071018; DE 102007049930 (B4) 2011-04-28

[3] J. Wochnowski et al., Modified multichannel structures and their production and use
Patents: WO 2008135542 (A1) 2008-11-13; WO2008EP55458 20080505; DE 102007020800 (A1) 2008-11-06; DE 102007020800 (A1) 2011-03-03; DE200710020800 20070503; DE102007020

First Results:

In the first step: Planar quartz glass plates were coated. The difference between the individual samples is only due to a change of the coating parameters.
Figure 2a (left) shows thermal coated plates and Figure 2b (right) photochemically coated plates.

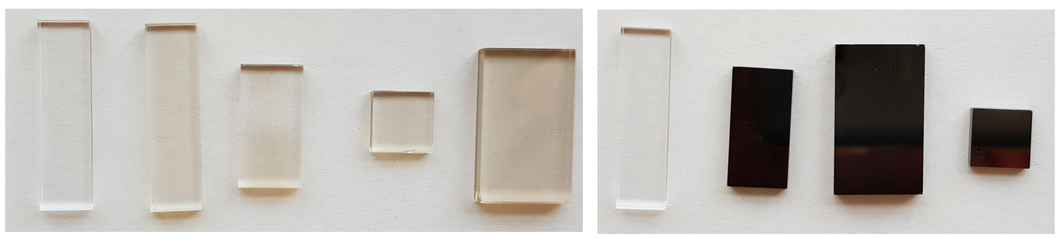

Figure 2: a) Thermally coated plates with reference sample (left) b) Photochemically -coated plates with reference sample (right).

In the second step: After successfully coating planar glass plates, geometrically more complex microstructures like multichannel tubes were used as coating substrate.

Figure 3 shows as an example for a by OMCVD coated multichannel microtube.[3]

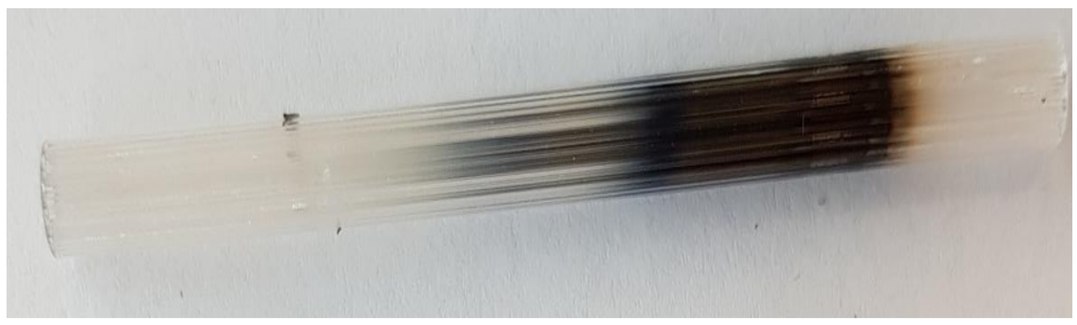

Figure 3: Thermally coated multichannel microtube.

Outlook:

For surface functionalisation of the internal three-dimensional structures of microstructures such as microchannels, numerous possible applications in microtechnology seems to be possible e.g. their use in microfluidics.

The Chemical Vapour Deposition of Organometallic compounds (OMCVD) seems to be the appropriate technology that allows metal deposition from the gas phase, even down to room temperature, without sustainably damaging these often very temperature sensitive microstructured substrates.

Thanks to

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