Development of new MOCVD-Precursors for TiC- and Ti_3SiC_2-Coatings

Münch, M., Essen/D

Prof. Dr. Stephan Schulz, Universität Duisburg-Essen, Universitätsstraße 5-7, 45117 Essen

Many materials for technical applications such as steel have to be covered with a hard material such as titanium carbide (TiC) to improve their technical properties eg abrasion and corrosion resistance. TiC coatings are typically deposited by CVD and PECVD processes (plasma enhanced chemical vapor deposition)[1] in which $TiCl_4$ is normally used as precursor. Unfortunately this compound leads to significant problems during the deposition processes, particularly the high corrosiveness of the precursor, the resulting high chlorine content in the film and the required high decomposition temperatures. Especially for high precision components, a high thermal stress and resulting deformation might be very problematic.[1]
In order to create Ti_3SiC_2-coatings, CVD-techniques with titanium halides (TiX_4), alkoxides ($Ti(OR)_4$) or amides ($Ti(NR)_4$) as precursors have been established.[2] However the high deposition temperatures of the titanium halides typically leads to contaminations of thermodynamically stable titanium- and siliconcarbide whereas oxygen- or nitrogen-containing precursors force the formation of titaniumoxide or -nitride. Consequently, alternate precursors with low decomposition temperatures have to be developed. Titanium alkyl or aryl complexes are promising candidates as will be demonstrated.

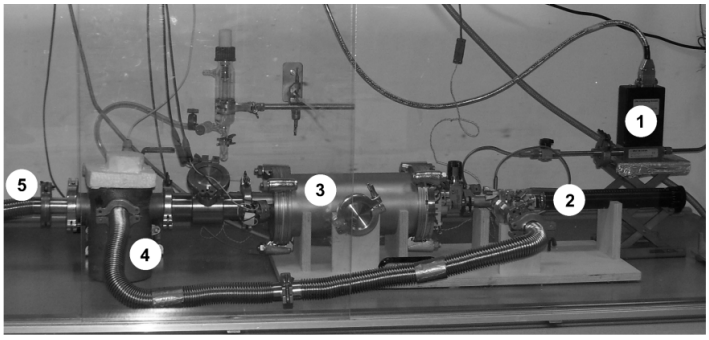

Figure 1. Cold wall MOCVD reactor: (1) mass flow controller for gas inlet, (2) driving rod with precursor source, (3) reactor with heatable substrate holder, (4) cryo trap, (5) outlet to vacuum pump

Cp^*TiMe_3[3] was synthesized and investigated in thermal CVD processes. TiC-containing coatings were deposited on silicon substrates at 700 degrees in a home-made MOCVD cold wall reactor (Figure 1). EDX-, SIMS-, EELS- and SAED-analysis show an amorphous TiC-film with diversifying carbon content (depending on deposition conditions) and a thin crystalline TiC-surface.

Literature: [1] P. Mayr, H.-R. Stock, *J. Vac. Sci. Technol. A* **1986**, *4* 2726. [2] C. Racault, F. Langlais, R. Naslain, *J. Mater. Sci.* **1994**, *29*, 3941. [3] M. Mena, P. Royo, R. Serrano, M. A. Pellinghelli, A. Tiripicchio, Organometallics **1989**, 8, 476.