Metal-Containing Thin Film MOCVD: Kinetics and Reaction Mechanisms

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The fabrication of metal-containing thin-film materials is currently an area of immense research activity and interest. These materials have found increasing application to a wide variety of technological problems including electronic materials, optoelectronics devices, superconducting materials, and device interconnects.¹

Several studies have demonstrated that good quality metal-containing thin films can be obtained by CVD using various metal-organic precursor.²⁻⁷ The accurate control of the MOCVD process as regarding growth rate, reproducibility, uniformity and purity of the deposited films is one of the most important goals for technological and industrial application.

In this contest the study of the kinetics and the reaction mechanisms of the process is a powerful tool for an intelligent optimization of the synthetic procedures. Furthermore, it is of relevance to the development of new organo-metallic precursors.

The deposition kinetics of various metal-organic precursor have been investigated under different operating conditions (i.e. reactant compositions, susceptor temperature, gas flow rate) in order to rationalize the mechanisms of the MOCVD processes. Particular attention has been devoted to the formation of copper containing phases using various organometallic and coordination complexes as precursors.

A multi-technique approach (x-ray fluorescence, XRD, AES, XPS) provides information on the growth rate and on the chemical nature of deposited films. Mathematical models can be proposed to rationalize the dependence of the growth rate and of film properties on the experimental parameter and precursor design.

References

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