Films of Metaloxides and Composites through Single Source Precursor CVD

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The use of molecular Single Source Precursors (SSP) in the formation of simple and complex solid materials using CVD methods is demonstrated for different oxygen based materials. We have shown that not only the stoichiometric ratio of the metallic elements is crucial for obtaining discrete phases but also the choice of the ligands can be of upmost importance especially for a clean process and for maintaining the contamination of undesired side products at a low level.(1)

So we were able to use mixed metal alkoxides of the type $(tBuO)_8MM'_2$ (M = Mg, Zn, Fe, Co, Ni, Cu; M' = Al, Fe) to produce thin films of spinels MM'_2O_4. The properties of the oxides are determined by several techniques like IR, solid state NMR, X-ray diffraction on powders, elemental analyses and EDX, microscopic techniques (like SEM or HR-TEM), surface reactivities, magnetic measurements etc. Prior to the use of these molecules in the CVD processes the structures of the molecules were determined by single crystal X-ray diffraction methods. Another approach to high purity oxide materials relays on a cascade of reactions during the CVD process. By this way the precursor $H_4(OtBu)_4MgAl_2$ transforms to nanoscopic $MgAl_2O_4$ which contains no detectable impurities; the by-products in this clean reactions are volatile hydrogen and iso-butene which can easily be pumped away.(2) In similar ways also thin films of pervoskites are obtained.

Besides these monophasic materials biphasic systems can be synthesized, always using single source precursors in the CVD process. The biphasic systems which can be of the type, metal/metal oxide, alloy/metal oxide and metal oxide/metal oxide are created at the same instance, are mixed on a nanometer scale and are produced under stoichiometric control. For example $NdAl_3(OiPr)_{12}(HOiPr)$ decomposes under mild conditions in the CVD process to form a 1 : 1 mixture of $NdAlO_3$ and Al_2O_3.(3)

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