Effect of Solvent on Growth of Ru and RuO_2 Films by Liquid Injection MOCVD

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We have grown Ru and RuO_2 thin films by liquid injection metal organic chemical vapor deposition (MOCVD) technique. Ru $(thd)_2(cod)$ precursor dissolved in an organic solvent was injected into the low pressure MOCVD reactor. Various solvents such as isooctane, n-octane, cyclohexane, xylene, n-propanol, dioxane and 2-methoxyethyl ether, (diglyme) were used. Depending on particular solvent and deposition conditions we were able to grow either RuO_2 or Ru films.

Surprisingly, deposition using chemically similar solvents, isooctane and n-octane, resulted in growth of RuO_2 and Ru films, respectively. Using infrared spectroscopy of reaction products we have determined different decomposition pathways for these solvents. In particular, decomposition of n-octane involves combustion in large extent and, consequently, decreases substantially partial pressure of oxygen in the reaction atmosphere. We point out that oxygen partial pressure is of crucial importance for RuO_2 phase growth.