Low-Temperature MOCVD Process for Deposition of Ir- and Hf-containing Refractory Films

N.B. Morozova
Nikolaev Institute of Inorganic Chemistry SB RAS

N.V. Gelfond
Nikolaev Institute of Inorganic Chemistry SB RAS

I.K. Igumenov
Nikolaev Institute of Inorganic Chemistry SB RAS

N.I. Baklanova
Institute of Solid State Chemistry and Mechanochemistry SB RAS

Follow this and additional works at: http://dc.engconfintl.org/uhtc

Part of the Materials Science and Engineering Commons

Recommended Citation

This Conference Proceeding is brought to you for free and open access by the Proceedings at ECI Digital Archives. It has been accepted for inclusion in Ultra-High Temperature Ceramics: Materials For Extreme Environmental Applications II by an authorized administrator of ECI Digital Archives. For more information, please contact franco@bepress.com.
Low-Temperature MOCVD Process for Deposition of Ir- and Hf-containing Refractory Films

N.B. Morozova¹, N.V. Gelfond¹, I.K. Igumenov¹, N.I. Baklanova²
¹Nikolaev Institute of Inorganic Chemistry SB RAS, Novosibirsk, Russia
²Institute of Solid State Chemistry and Mechanochemistry SB RAS, Novosibirsk, Russia

MOCVD Technique

Chemistry of precursor plays a key role in MOCVD processes

Main Stages of MOCVD Process:
- Vaporization of precursor;
- Mass transfer of precursor vapor to heated substrate;
- Thermal decomposition of vapor on surface with formation of coating material.

Analysis for each precursor

1. Thermal properties
   DTA/TG data

2. Volatility data
   (vapor pressure)

3. Thermodecomposition
   of precursor vapor

Life duration in solid state
Evaporator temperature
Deposition temperature

Pressure: $10^{-4}$ Torr - atm,
T deposition: 50 - 600°C,
Thickness: some nm - tens of µm
Substrates: SiO$_2$, Al$_2$O$_3$, Si, SiC, Cu, Mo, Ti, steel, quartz, ceramics, YBa$_2$Cu$_3$O$_7$, carbon fibers, et al.
Precursors of Hf, Zr and Pt Group Metals for Forming Coatings by MOCVD

**Metals:**

Zr(IV), Hf(IV), Rh(III), Ru(III), Ir(III), Pd(II), Pt(II, IV)

**Ligands:**

X, Y = O, NR₃
R', R'' = CF₃, Alk, Ar

Hal = F, Cl, Br, I

R = H, Alk
R = Alk

Ir(acac)₃
Hf(thd)₄
**TG curves:** 1 – Hf(hfac)$_4$ + [Hf(OH)(hfac)$_3$], 2 – Hf(tfac)$_4$, 3 – Hf(ptac)$_4$, 4 – Hf(thd)$_4$, 5 – Hf(acac)$_4$

**P/T dependencies:** 1 – Ir(acac)$_3$; 2 – Ir(thd)$_3$; 3 – Ir(ptac)$_3$; 4 – Ir(hfac)$_3$; 5 – Ir(cod)(acac); 6 – Ir(cod)(Cp'); 7 – Ir(CO)$_2$ (acac); 8 – Ir(CO)$_2$ (Cp').

**In situ high temperature mass spectrometry for Hf(thd)$_4$ in oxygen.**

**MOCVD deposition of Ir- and Hf-containing layers**

**Products of MOCVD processes**

**Volatile metal compounds**

**H$_2$**

**O$_2$**

**Metals (Pt, Ir, Ir/Pt, Pd, Ru, Rh, Au, Re, Ni, Co, Cu)**

**Oxides (Al, Ga, In, Zr, Cr, Ru, Pb, Hf, Ce, Y, Sc, Mg)**

**Composites (Ir/IrO$_2$, Ru/RuO$_2$, YSZ, Pt/Ir/IrO$_2$, Ir/Al$_2$O$_3$)**

**Fluorides (Ca, Mg, Ba, Sr)**