Metallo-Organic Decomposition (MOD) Films

Introduction

Materials

Process

Status

What are Metallo-Organic Compounds?

\[
\text{Metal} \quad \text{Hetero-Atom (O,S,N)} \quad \text{Organic Radical}
\]

\[
\text{Common Solvent}
\]

\[
\text{Rheology Adjusters} \quad \text{Raw Film}
\]

\[
\text{Process} \quad \text{Process}
\]
PLENARY SESSIONS

Advantages of MOD Compounds

- Generic synthesis procedures
- High solubility in organic solvents
- High uniform metal content
- Lower firing temperatures
- Decompose without melting or leaving a carbon deposit
- Stable under ambient conditions
- Non-toxic — do not produce toxic decomposition products

Disadvantages of MOD Compounds

- Low inorganic content
- Limited information available on pure compounds
- Large volume of volatiles

Molecular Design Criteria

- As the chain length of the organic radical increases:
  1. The solubility of the compound in organic solvent increases
  2. The metal content of the compound decreases
- The solubility of the compound increases if the organic radical is branched
Compounds Formulated

2-ETHYLHEXANOATES

Bi, Cd, Co, Cr, Cu, Ga, In, Ir, Ni, Pb, Rh, Ru, Si, Sn, Y, Zn, Zr

AMINE 2-ETHYLHEXANOATES

Au, Pt

NEODECA-4OATES

Ag, Ba

OTHER

B pyridine
Pd acetate
Sb stiboxide
Ti 2-ethylhexoxide

Reactions

\[ R_1 - C - COOH + NH_4OH \xrightarrow{H_2O, 25^\circ C} R_1 - C - COONH_4 + H_2O \]

\[ R_2 - C - COONH_4 + AgNO_3 \xrightarrow{H_2O, 25^\circ C} R_2 - C - COOAg + NH_4OH \]

\[ R_1 + R_2 + R_3 \rightarrow C_9H_{19} \]

Wt % SILVER: 38.7
FORM: WHITE SOLID
SOLUBILITY: AROMATIC SOLVENTS

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Phase Stability Diagram for the Ag-C-O System

TEMPEERATURE, °C

LOG P02

CO, CO2

C

TGA

SAMPLE: SILVER NEODECANDATE
SIZE: 13.2 mg
RATE: 10°C/min - #1 RUN
PROGRAM: TGA ANALYSIS V1.0

RESIDUAL WEIGHT, %

TEMPERATURE, °C
DSC

SAMPLE: SILVER NEODECANOATE
SIZE: 36.6 mg
RATE: 10°C/min in air
PROGRAM: INTERACTIVE DSC V2.0

Status

- Materials
  Ag  AgNi
  AgPt  AgCo
  AgBiPt  AgCr
  AgBi

- Processes
  - Application methods
    - Thick-film screening
    - Ink-jet printing
    - Spin-on
    - Spray
    - Dip
  - Pyrolytic decomposition
    - Resistance furnace
    - Coherent light
    - Incoherent light
PLENARY SESSIONS

- Applications
  - Photovoltaic devices
  - VLSI devices
  - Hybrid microelectronics
  - Hermetic sealing

- Technology transfer:
  - New technology disclosures
  - Papers
    - ISHM
    - SPIE
    - ECS
    - MRS
  - Industry availability