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Importance of Trimethylaluminum Diffusion in Three-Step ABC Molecular Layer Deposition Using Trimethylaluminum, Ethanolamine, and Maleic Anhydride Jan 2010 8 pages

Authors: Dragos Seghete; Robert A Hall; Byunghoon Yoon; Steven M George; COLORADO UNIV AT BOULDER DEPT OF CHEMISTRY AND BIOCHEMISTRY

Full Text

Hybrid organic-inorganic films were grown by molecular layer deposition (MLD) with a three-step ABC reaction sequence using (A) **trimethylaluminum** (TMA), (B) ethanolamine (EA), and (C) maleic anhydride (MA) at 90 oC. Very large steady state mass gains of 1854-4220 ng/(cm2 cycle) were measured depending on reaction conditions. These mass gains are much larger than typical mass gains for surface reactions. The quartz crystal microbalance (QCM) mass profiles during the TMA reaction were consistent with TMA diffusion into and out of the ABC films. The ABC mass gains per cycle also displayed a ...

Reactions of Trimethylaluminum with Secondary Arsines: Synthesis and Characterization of Phenyl (trimethylsilylmethyl)arsine, Ph(Me3SiCH2)AsH, and the X-Ray Crystal Structures of the Trimers, Me2AlAsPh2!3.(C7H8)2 and Me2AlAs(CH2SiMe3)Ph3 Dec 20, 1995 33 pages

Authors: Janeen A. Cooke; Andrew P. Purdy; Richard L. Wells; Peter S. White; DUKE UNIV DURHAM NC DEPT OF CHEMISTRY

Full Text

The reactions of **trimethylaluminum** with diphenylarsine, Ph2AsH, and phenyl(trimethylsilylmethyl)arsine, Ph (Me3SiCH2)AsH, in 1:1 mole ratios afford the trimeric compounds Me2AlAsPh23.(C7H8)2 (1) and Me2AlAs (CH2SiMe3)Ph3 (2), respectively. Compounds 1 and 2 are the first Al-As six-membered ring compounds to be structurally characterized by single-crystal X-ray crystallography, as well as 1H and 13C solution NMR spectroscopy. X-ray crystallographic analysis revealed that trimer 1 is a toluate which crystallizes in the monoclinic space group P 2 sub 1/n, with a = 14.549(6) A, b =22.838(7) A, c = ...

An Analysis of the Visible Chemiluminescence Observed in the Gas-Phase Oxidation of Aluminum and Its Compounds Apr 1974 45 pages

Authors: C. E. Kolb; D. R. Herschbach; M. E. Gersh; AERODYNE RESEARCH INC BILLERICA MA

Full Text

... Pi) and/or lowest-lying quartet sigma(+) and quartet Pi states of AlO is suggested as an explanation for the visible chemiluminescence often observed in the gas-phase oxidation of aluminum. Data from upper atmospheric chemical release experiments utilizing aluminized grenades, aluminized burners, and **trimethylaluminum** are examined, and AlO(*) pumping steps based on the reaction of molecules containing loosely bound aluminum atoms with atomic oxygen are suggested. Previously proposed theories are shown to be unable to reproduce reasonably the observed data. The results of selected, recent ...

Polymeric Aluminasilazane Precursors for Aluminosilicon Nitride May 4, 1990 9 pages

Authors: Dietmar Seyferth; Gregor Brodt; MASSACHUSETTS INST OF TECH CAMBRIDGE DEPT OF CHEMISTRY

Full Text

The reaction of **trimethylaluminum** with the cyclic oligomers obtained by ammonolysis of methyldichlorosilane results in evolution of methane and formation of soluble, cross-linked aluminasilazanes. Pyrolysis of the products in a stream of argon gives a good yield of black aluminosilicon carbonitride, while pyrolysis in a stream of ammonia results in formation of white aluminosilicon nitride. Keywords: Silicon nitride, Aluminum nitride, Silicon carbonitride, Preceramic polymers, Organosilicon compounds, Organoaluminum compounds, Polysilazanes, Magneto-optical recording materials. (jg)

Synthesis, Structure and Pyrolysis of Organoaluminum Amides Derived from the Reaction of Trialkylaluminum Compounds with Ethylenediamine in a 3:2 Ration Aug 1990 38 pages

Authors: Zhiping Jiang; Leonard V. Interrante; Daekeun Kwon; Fook S. Tham; Rudy Kullnig; RENSSELAER POLYTECHNIC INST TROY NY DEPT OF CHEMISTRY

Full Text

The reactions of triethylaluminum and **trimethylaluminum** with ethylenediamine (en) in a 3:2 ratio have been studied. Heating of the initially formed 2R3Al:en and R3 Al:en adduct mixture results in the formation of RA1((HN (CH2)2NH)A1R2)2 (R = CH3 and C2H5). The structures and formation mechanisms of these two compounds, as well as their pyrolysis reactions, have been studied with H, C, A1 NMR, FTIR, MS, GC, DSC, and TGA. The methyl derivative was characterized by a single crystal X-ray diffraction analysis.

Laser Assisted CVD Growth of A1N and GaN

Oct 10, 1991 35 pages

Authors: Joshua B. Halpern; Joan M. Frye; Gary Harris; M. Aluko; HOWARD UNIV WASHINGTON DC

Full Text

... chemical vapor deposition processes (LI-CVD), specifically for the growth of AIN. In the past year we have made progress in three areas: (a) Rapid growth of AIN thin films by laser ablation of AIN powders. (b) Demonstration of an advanced LI-CVD method for deposition of Al from **trimethylaluminum** (TMA1). This method was designed to be used as the aluminum atom source in AIN growth, but also has utility for laser deposition of aluminum interconnects, an area of current interest. (c) Synthesis and characterization of a number of stable alkyl aluminum-nitrogen containing adducts for future use in ...

Molecular Layer Deposition of Hybrid Organic-Inorganic Alucone Polymer Films Using a Three-Step ABC Reaction Sequence Nov 2, 2009 11 pages

Authors: Byunghoon Yoon; Dragos Seghete; Andrew S Cavanagh; Steven M George; COLORADO UNIV AT BOULDER

Full Text

Thin film growth using molecular layer deposition (MLD) or atomic layer deposition (ALD) is based on sequential, self-limiting surface reactions. In this work, MLD is used to grow a hybrid organic-inorganic polymer film based on a three-step ABC reaction sequence using **trimethylaluminum** (TMA), ethanolamine (EA), and maleic anhydride (MA) as the reactants. This three-step ABC sequence avoids the use of homobifunctional organic precursors by employing a homotrifunctional inorganic reactant (TMA), a heterobifunctional organic reactant (EA), and a ring-opening organic reactant (MA). The resulting ...

Epitaxial Graphene Surface Preparation for Atomic Layer Deposition of Al2O3 Jun 2011 7 pages

Authors: N. Y. Garces; V. D. Wheeler; J. K. Hite; G. G. Jernigan; J. L. Tedesco; Neeraj Nepal; Jr. Eddy C. R.; D. K. Gaskill; NAVAL RESEARCH LAB WASHINGTON DC

Full Text

Atomic layer deposition was employed to deposit relatively thick (30 nm) aluminum oxide (Al2O3) using **trimethylaluminum** and triply-distilled H2O precursors onto epitaxial graphene grown on the Si-face of silicon carbide. Ex situ surface conditioning by a simple wet chemistry treatment was used to render the otherwise chemically inert graphene surface more amenable to dielectric deposition. The obtained films show excellent morphology and uniformity over large (64 mm2) areas (i.e., the entire sample area), as determined by atomic force microscopy and scanning electron microscopy. X-ray ...

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