



HAL
open science

CVD of pure copper films from amidinate precursor

Vladislav V. Krisyuk, Lyacine Aloui, Nathalie Prud'Homme, Bartosz Sarapata,
François Senocq, Diane Samélor, Constantin Vahlas

► **To cite this version:**

Vladislav V. Krisyuk, Lyacine Aloui, Nathalie Prud'Homme, Bartosz Sarapata, François Senocq, et al.. CVD of pure copper films from amidinate precursor. ECS Transactions, 2009, 25 (8), pp.581-586. <10.1149/1.3207643>. <hal-03565671>

HAL Id: hal-03565671

<https://hal.science/hal-03565671v1>

Submitted on 11 Feb 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire HAL, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



HAL Authorization



Open Archive Toulouse Archive Ouverte (OATAO)

OATAO is an open access repository that collects the work of Toulouse researchers and makes it freely available over the web where possible.

This is an author -deposited version published in: <http://oatao.univ-toulouse.fr/>
Eprints ID: 3862

To link to this article: DOI/10.1149/1.3207643

<http://dx.doi.org/10.1149/1.3207736>

To cite this version: Aloui, Lyacine and Krisuyk, Vladislav and Prud'homme, Nathalie and Sarapata, Bartosz and Senocq, François and Samélor, D. and Vahlas, Constantin (2009) *CVD of pure copper films from amidinate precursor*. ECS Transactions, vol. 25 (n° 8). pp. 581-586. ISSN 1938-6737

Any correspondence concerning this service should be sent to the repository administrator:
staff-oatao@inp-toulouse.fr

CVD OF PURE COPPER FILMS FROM AMIDINATE PRECURSOR

Lyacine Aloui¹, Vladislav Krisuyk^{1,2*}, Nathalie Prud'homme¹, Bartosz Sarapata¹, François Senocq¹, Diane Samélor¹, Constantin Vahlas¹

¹ CIRIMAT, ENSIACET, 118 route de Narbonne, 31077 Toulouse Cedex 04, France

² Nikolaev Institute of Inorganic Chemistry SB RAS, Novosibirsk 630090, Russia, vladislav.krisuyk@ensiacet.fr

Chemical vapour deposition of aluminium-copper-iron intermetallic compounds implies the use of compatible precursors for the involved elements. The component metals in this system have different chemical properties which govern the choice of the right precursors. Specifications for such precursors include oxygen-free ligands and similar deposition conditions. This presentation reports on the use of a novel copper amidinate compound Copper(I)*N,N'*-diisopropylacetamidinate [Cu(i-Pr-Me-AMD)]₂ (¹) to produce copper films in conventional low pressure CVD using hydrogen as reducing gas-reagent. This is relatively air-stable substance which has been tentatively tested in the literature as ALD precursor².

Saturated vapour pressure of [Cu(i-Pr-Me-AMD)] was first measured by static method. Then, copper films were deposited on steel, silicon and oxidized silicon substrates in the temperature range 200°C – 300°C and total pressure of 10 Torr. Their composition, morphology, conductivity and growth rate have been investigated by electron probe microanalysis (EPMA), grazing incidence X-ray diffraction (GIXRD) and scanning electron microscopy (SEM). Films are composed of polycrystalline copper metal without carbon and nitrogen impurities. Typical XRD pattern of the copper films is presented in fig. 2. The deposition rate has been evaluated directly by weight difference and indirectly by EPMA in the whole temperature range. The obtained Arrhenius plot is presented in fig. 3. Linear fit in the range 200-240 °C gives a slope ~65 kJ/mol which is remarkably close to hydrogen dissociation energy on copper surface². The copper films were shiny metallic and specular in reflection on well polished substrates and conductive with respect to dielectric substrates. CVD copper has denser nucleation and smoother surface morphology on metallic substrates. The grains size increases gradually with deposition temperature from ~20 nm at 200 °C to ~200 nm at 300 °C (fig. 4, 5).

Thus, good storage stability in combination with the determined processing window and the characteristics of the deposited films make [Cu(i-Pr-AMD)]₂ a promising CVD precursor for the MOCVD of Al and Cu-containing intermetallic alloy films.

References

1. B. S. Lim, A. Rahtu, J.-S. Park and R. G. Gordon, *Inorg. Chem.*, 2003, **42**, 7951.
2. B. S. Lim, A. Rahtu and R. Gordon, *Nature Materials*, 2003, **2**, 749

Fig. 1: Structural representation of the precursor.

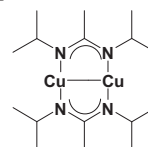


Fig. 2: XRD analysis of the film deposited at 300°C: 1) Si substrate, 2) steel substrate.

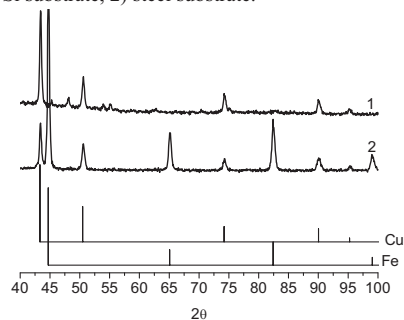


Fig. 3 The growth rate on steel substrate.

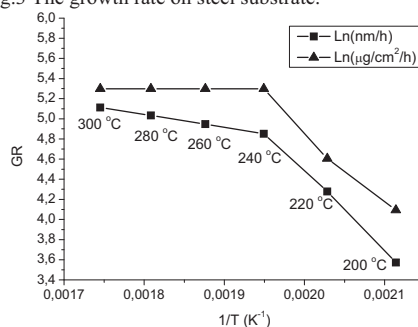


Fig. 4: The micrograph of copper films CVD at 240°C.

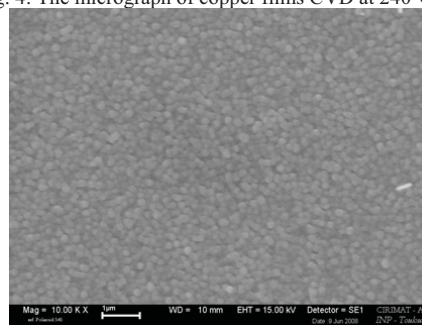


Fig. 5: The micrograph of copper films CVD at 300°C.

