ELSEVIER

Applied Surface Science 86 (1995) 509–513

applied surface science

Excimer laser-induced deposition of copper from Cu(hfac)(TMVS)

Ricardo Izquierdo *, Joan Bertomeu [1], Marc Suys, Edward Sacher, Michel Meunier

Groupe des Couches Minces and Département de Génie Physique, École Polytechnique de Montréal, P.O. Box 6079, Station "Centre Ville", Montréal, Québec H3C 3A7, Canada

Received 27 May 1994; accepted for publication 20 September 1994

Abstract

Copper films have been deposited on TiN and fluoropolymer substrates from the KrF excimer-laser-assisted decomposition of Cu(hfac)(TMVS). Using H_2 as the carrier gas, very uniform, shiny metal-like films were deposited with grain size of 50 to 100 nm. XPS measurements show that the precursor is reduced to metallic copper, and that a Cu/C atomic ratio of up to 17 is obtained.

1. Introduction

Copper has been proposed as a replacement for aluminum and aluminum-based alloys in the fabrication of ultra-large-scale integration (ULSI) interconnects. In the last few years, various techniques for the deposition of Cu have been investigated [1]. Among these, the chemical vapor deposition (CVD) using Cu(I) organometallic precursors has achieved good results, permitting the deposition of thin copper films having near-bulk resistivities [2]. However, Cu is difficult to pattern with submicronic resolution. Therefore, in order to obtain the desired interconnects array, the deposition has to be done in a selective way. This is difficult to achieve since the control of the selectivity in thermal CVD depends greatly on the experimental conditions, as well as on the quality of the surface on which the copper is deposited [3,4].

A technique which deposits copper in a selective manner, without dependence on surface quality, would therefore be quite attractive. Laser-induced CVD is one such technique where the desired interconnects pattern can be projected on the surface with the appropriate mask and lenses (projection patterning) [5] or written by moving the sample under the focused laser beam (direct writing) [6]. The laser direct writing of Cu, using an Ar^+ laser, has been recently demonstrated by Han and Jensen [7] but such a process, even if appropriate for circuit repair, is too slow for circuit production. Furthermore, submicronic resolution is difficult to achieve with this technique.

Excimer-laser CVD of copper from various Cu(II) precursors has been studied by several groups [8,9]. Poor results have been obtained up to now showing

* Corresponding author. Fax: 514 340 3218; E-mail: JG01@POLYTEC1.POLYMTL.CA.

[1] Permanent address: Laboratori de Física de Capes Fines, Departament de Física Aplicada i Electrònica, Universitat de Barcelona, Av. Diagonal 647, E-08028 Barcelona, Spain.

0169-4332/95/$09.50 © 1995 Elsevier Science B.V. All rights reserved