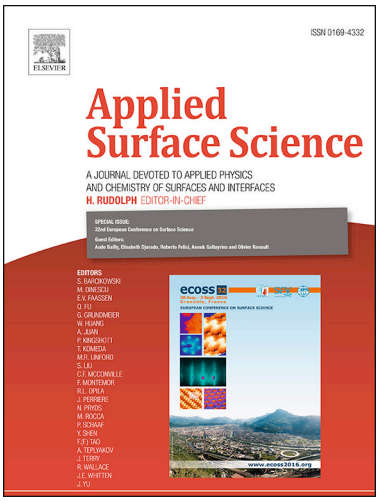

Full Length Article

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Interface chemistry and surface morphology evolution study for $InAs/Al_2O_3$ stacks upon *in situ* ultrahigh vacuum annealing

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Keywords: elemental diffusion, surface morphology, high-k dielectrics, InAs, thermal stability

Abstract: A systematic study of the interfacial chemistry for the HCl pretreated and native oxide InAs(100) samples upon atomic layer deposition (ALD) of Al_2O_3, and the post deposition annealing (PDA) process has been carried out, using *in situ* synchrotron radiation photoelectron spectroscopy. The "clean up" effect for the native oxide sample is detected, but it is not observed for the HCl pretreated sample. The out-diffusion and desorption of both In and As oxides have been characterized during the ALD process and the following PDA process. The surface morphology evolution during the PDA process is studied by *in situ* photo-emission electron microscopy. The bubbles emerged after PDA at 360 °C and grew up at 370 °C. After PDA at 400 °C and at higher temperatures, pits are seen in some areas, and the tear up of the Al_2O_3 film is seen in other areas with the formation of indium droplets. This study gives insight in the mechanism of elemental diffusion/desorption, which may associate the reliability of III-V semiconductor based devices.

1. Introduction

Group III-V compound semiconductor materials, such as InGaAs, InAs and GaAs, are strong contenders for Si in the sub 10 nm technology node for the potential low power

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