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The effect of heating on InGaAs/InP(1 0 0) and $InPO_4$/InP(1 0 0)

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Abstract

We have used Auger and electron energy loss spectroscopy to study the effect of temperature on InGaAs and $InPO_4$ grown on InP. The thickness of $InPO_4$ is of about 10 Å whereas that of InGaAs is of about 800 Å. $InPO_4$ is of great interest because it protects InP from loss of stoichiometry when heated to 450 °C. The InGaAs system heated at 450 °C seems to be unstable; metallic indium appears on the surface in conjunction with formation of GaAs.

Keywords: EELS; Auger; InP; $InPO_4$; InGaAs; Thermal stability

1. Introduction

The III–V compound InP is of great importance because of its high electronic mobility and its good optical properties. It is known that InP is very sensitive to physical treatments such as cleaning by argon ion bombardment or heating in UHV. These treatments break (In–P) chemical bonds followed by loss of P leading to an excess of element III on the surface [1–3]. Some suggestions have been proposed to restore the surface stoichiometry namely the evaporation of element V such as phosphorus or antimony on InP(1 0 0) previously cleaned in UHV [4].

The ternary compound InGaAs is interesting for technological applications because it has a high electron mobility of 13000 $cm^2 V^{-1} S^{-1}$ at 300 K and a low band gap of 0.76 eV at 300 K [5]. It is widely used for light emission in the range of 1.3–1.5 μm in diode emitters and laser radiation as well as in detectors.

InP gives Schottky diodes of good quality. It has been reported that oxidation of InP by UV radiation protects the InP surface against decomposition during deposition of metals like Au on InP [6]. The device so obtained Au-coated InP with an oxide beneath the metal gives a Schottky barrier height in the range of 0.8 eV. Schwartz et al. [7] have reported that InP exposed to oxygen plasma at temperatures below 340 °C leads to the formation of a native oxide $InPO_4$ layer of about 20 Å thickness. Such a system has been measured by the X-ray photoelectron spectroscopy (XPS).

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