

Low defect density epitaxial Cu thin films grown by pulsed electrochemical deposition on n-GaAs(011)

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Copper thin films were epitaxially grown on n-GaAs(011) substrates by using pulsed electrodeposition with current densities 20 mA/cm² at room temperature. The thicknesses of the films range from 20 to 165 nm. The thickness calibration was done by temperature dependence of resistance and Hall effect which are comparable to those obtained from XRR in the case of smooth films.

High angle ω -2 θ XRD scans show Cu(111) thin film on n-GaAs(011) (Figure 1). In plane ϕ -scan of the Cu(220) peak shows six fold symmetry indicating the epitaxial growth with the epitaxial relationship Cu(111)[110]//GaAs(011)[110]. The resistivity was measured as a function of Cu film thickness and temperature and can be described by Fuchs' model¹ (Figure 2). The bulk resistivity are 0.28 $\mu\Omega\text{cm}$ and 1.85 $\mu\Omega\text{cm}$ and the mean free paths are corresponding to 232 nm and 35 nm at 20 K and 290 K, respectively.² The low value of the bulk resistivity at 20 K and the bulk residual resistance ratio of 6.5 indicate a very low defect density

References

1. K. Fuchs, Proc. Camb. Phil. Soc. 34, 100 (1938)
2. Nail W. Ashcroft, N. David Mermin, Solid State Physics, WB Saunder, Philadelphia, 1976.

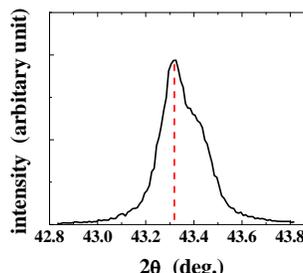


Fig. 1. High-angle ω -2 θ XRD spectrum measurement showing Cu(111) grown on GaAs(011).

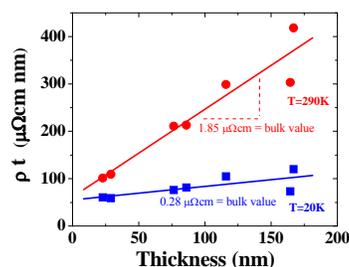


Fig. 2. Thickness dependence of the resistivity times the thickness ρt measured at 20K (squares) and 290K (circles), respectively. The straight lines are the best fit according to Fuchs' model.