氮化鎵元件之歐姆接觸銅製程與其材料分析
The Cu-based Ohmic Contact and its Material Analysis of GaN Devices

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Experimental Sections

Wafer clean

Mesa lithography

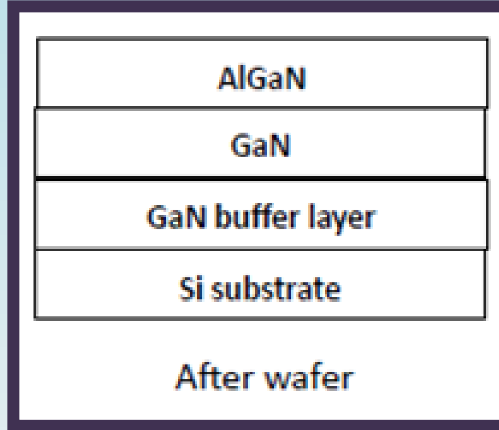
ICP etch (Ar/Cl_2)

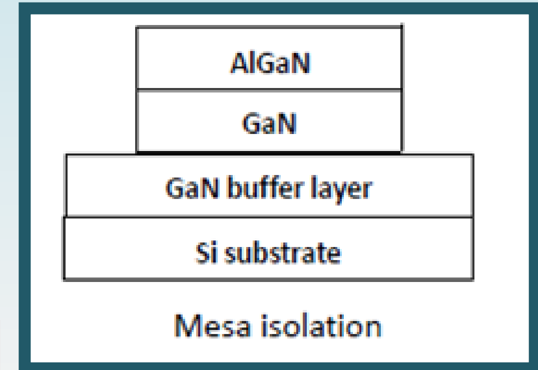
Ohmic lithography

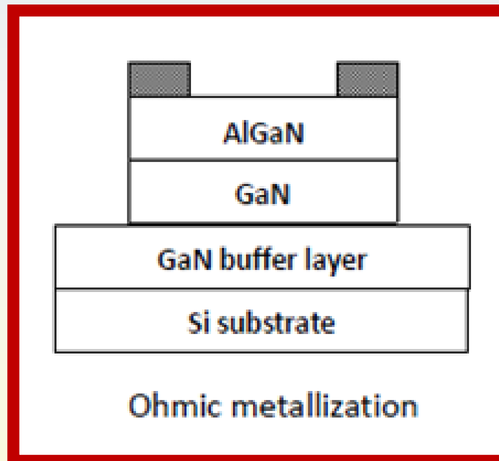
Metal deposition

Lift-off process

Heat treatment by RTA

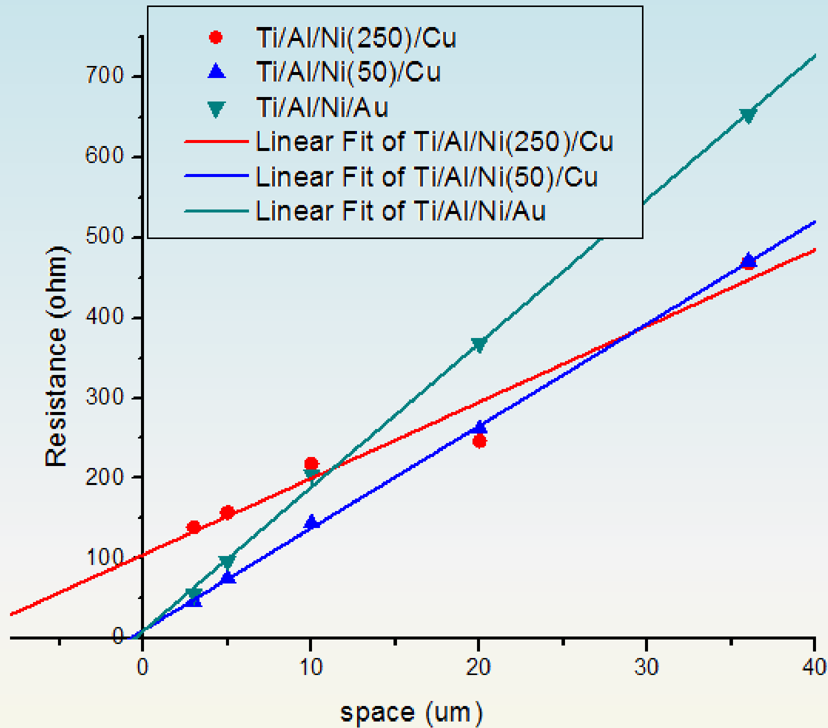


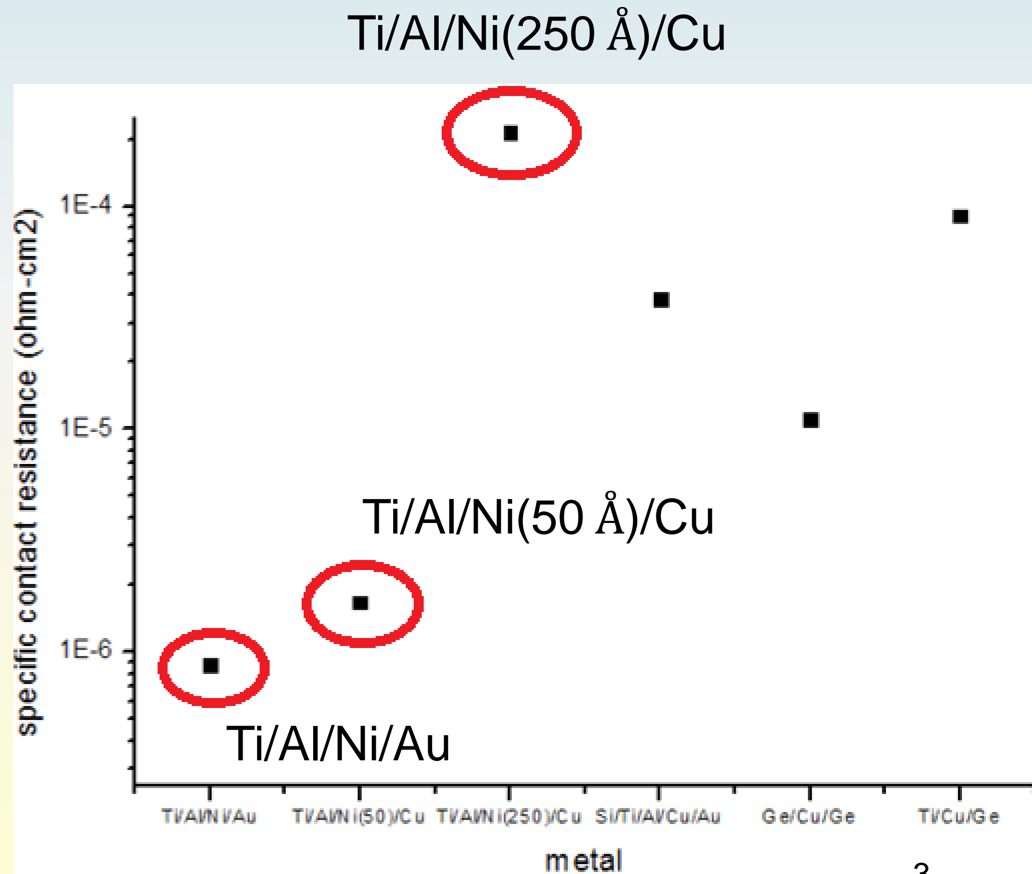




- Ti/Al/Ni/Au (200/1200/250/1000) Å
- Ti/Al/Ni/Cu (200/1200/250/1000) Å
- Ti/Al/Ni/Cu (200/1200/50/1000) Å

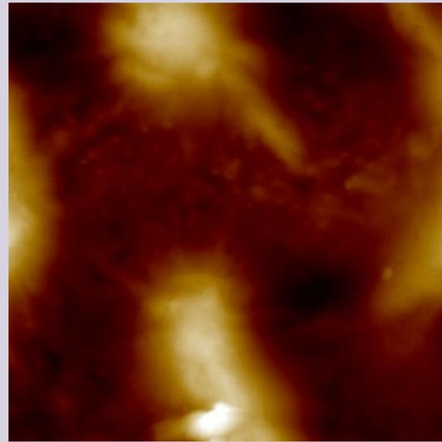
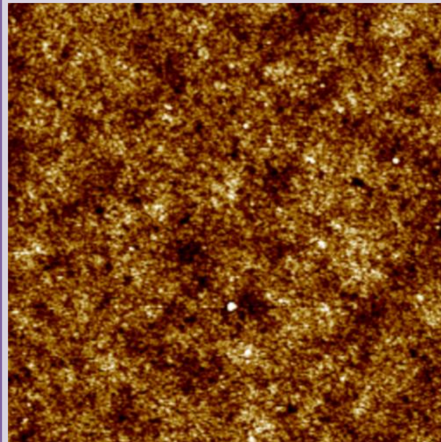
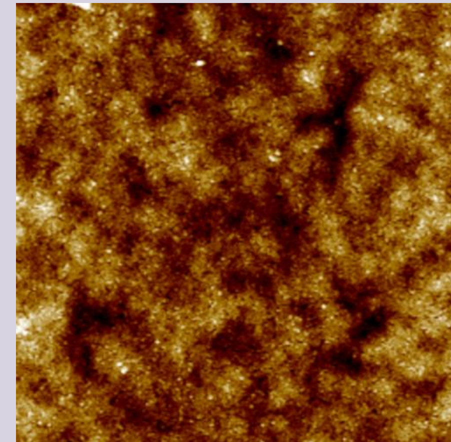
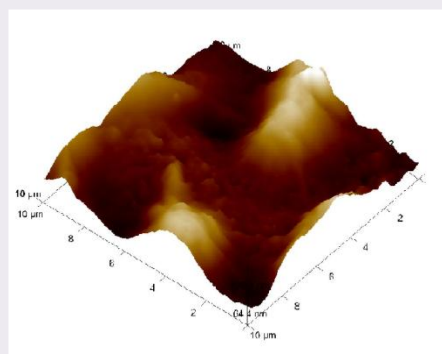
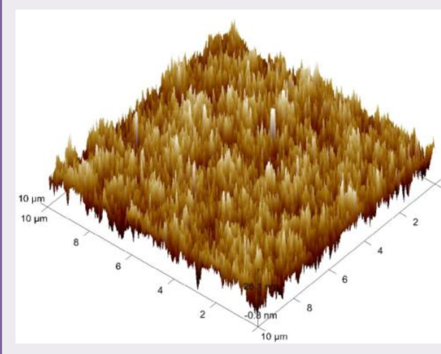
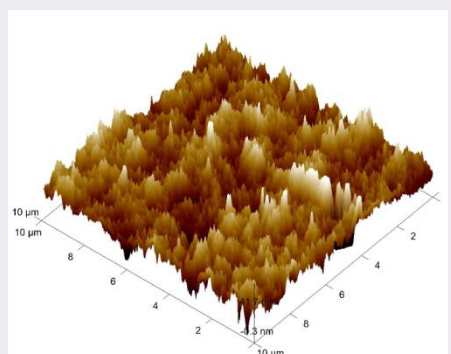
DC Measurement



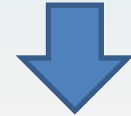


Atomic force microscope

After RTP:

Ti/Al/Ni/Au	Ti/Al/Ni(50 Å)/Cu	Ti/Al/Ni(250 Å)/Cu
		
		
rms~134nm	rms~7.62nm	rms ~12.5nm

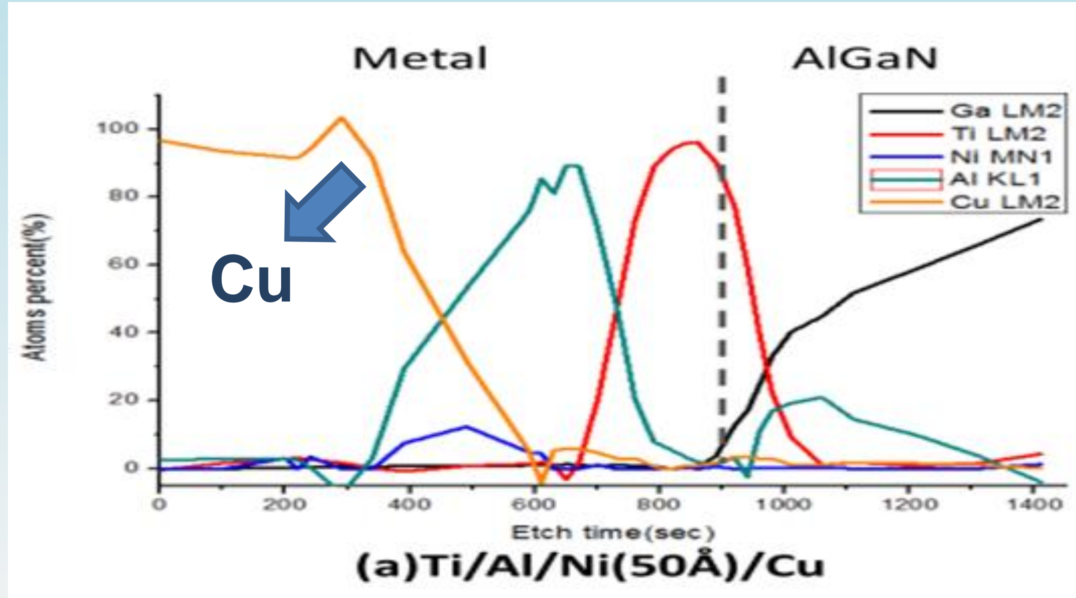
Ti/Al/Ni(50 Å)/Cu after RTP has lower surface roughness



1. Good surface morphology
2. Good line edge definition

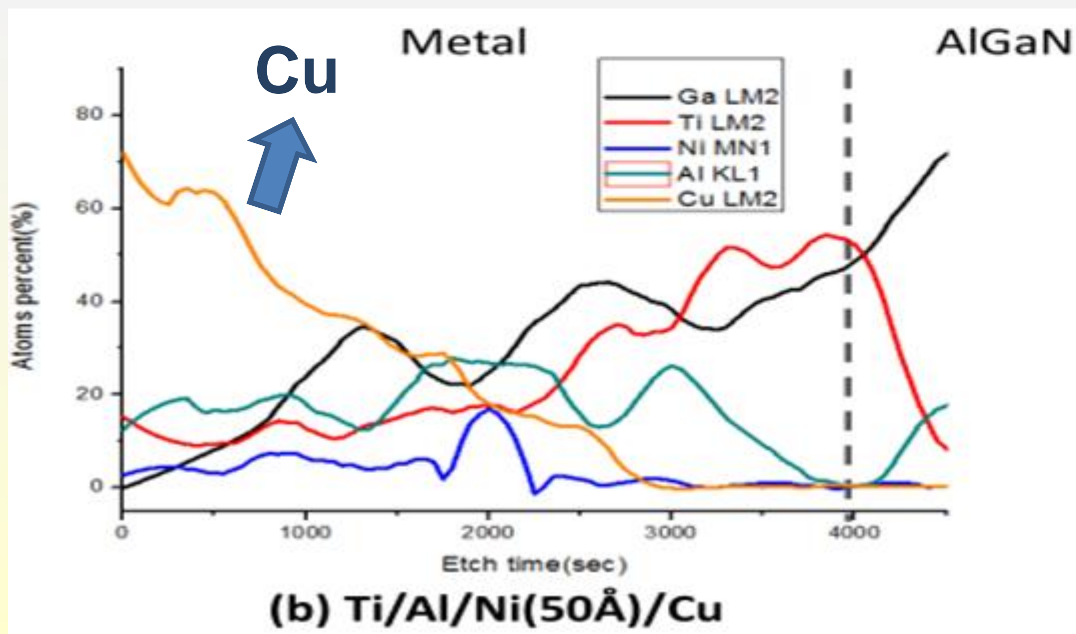
Auger depth profile

Before RTA:



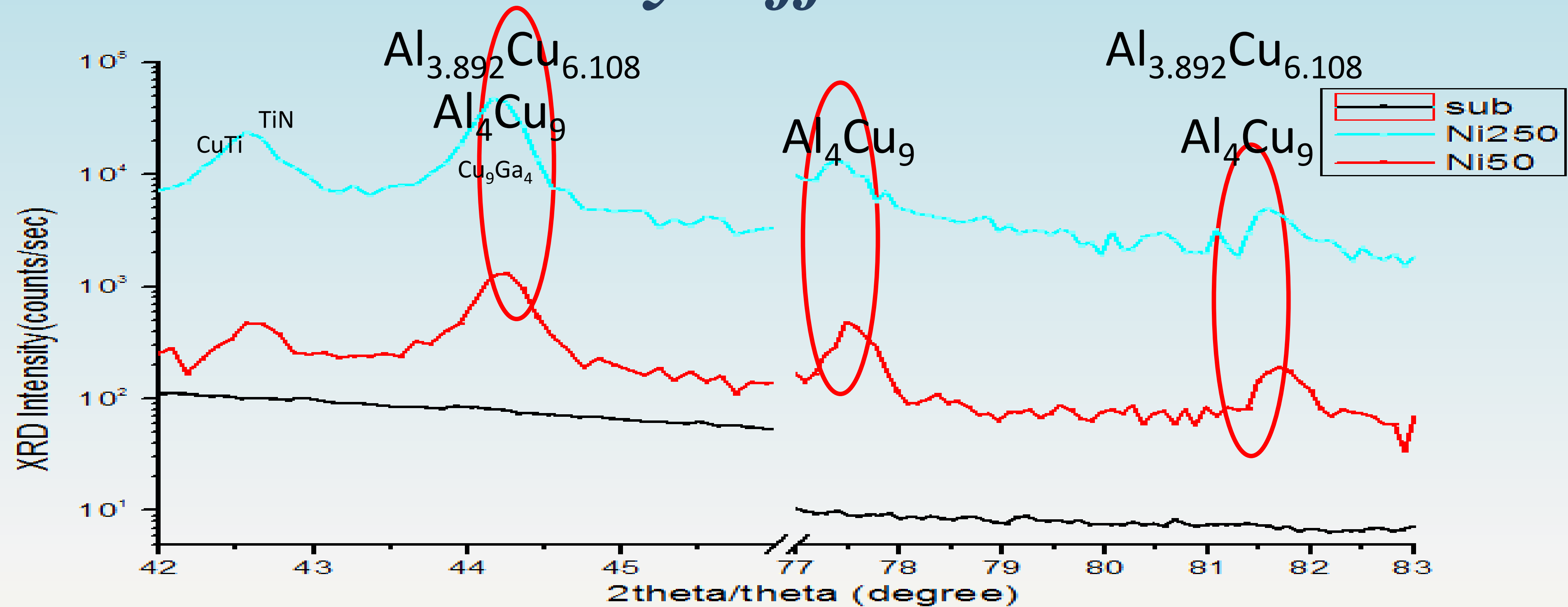
◆ Each point is measured after 50sec sputter etch with Ar ion.

After RTA(900℃-30sec):



◆There's no Cu diffused into the AlGaN layer.

X-ray diffraction



Alloy	2θ/θ Degree(main)	2θ/θ Degree(second)	2θ/θ Degree (other)
Al_4Cu_9	44.106	81.13	77.47
$Al_{3.892}Cu_{6.108}$	44.27	81.403	64.26

-Jcpdfwin software data

Ti/Al/Ni(50Å)/Cu

- The Cu diffusion was interfered by the Al_3Ti. Further more, there's no Cu diffused into the AlGaN layer. — *Materials Chemistry and Physics*, vol. 41, pp. 199-205, 1995.

Matrix solutant(%)	Diffusant	$D_{b0}(cm^2 s^{-1})$
Al	Cu	0.9
Cu	Cu	0.156
$TiAl_3 0.5Cu$	Cu	$2.7*10^{-3}$

Conclusion

- **A low specific contact resistance of $1.67*10^{-6}$ Ω-cm² with optimized Ti/Al/Ni(50Å)/Cu metallization has been fabricated.**

- **The smooth surface with 7.62 nm rms roughness has been reached on sample with thinner Ni layer(50Å).**