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In situ x-ray scattering studies on the structural evolution of Ni/Au films on *p*-type GaN during thermal oxidation in air

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The structural evolution of the Au/Ni/*p*-GaN sample during thermal oxidation in air was investigated by *in situ* and high-q x-ray scattering experiments. The Au/Ni/*p*-GaN samples were oxidized at about 350℃ continuously in air. After thermal oxidation of Au/Ni/*p*-GaN, the domain size of Au phase doubled in thickness roughly. In the Au(111) Bragg reflection of the Au(100Å)/Ni(100Å)/*p*-GaN during thermal oxidation, peak-broadening was observed. This indicates that Au(111) Bragg reflection peak was overlapped with Au-rich solid solution. This structural evolution was observed in the Au(400Å)/Ni(400Å)/*p*-GaN sample in detail. In addition, using high-q x-ray scattering after thermal oxidation at 350℃, the oxidation reaction and diffusion behavior were investigated as a function of annealing time. These results suggest that in the Ni/Au bilayer on *p*-type GaN during thermal oxidation in air, Ni outdiffusion causes two distinct Au-rich solid solution with the different amount of Ni atoms. Finally, two Au-rich solid solution developed into Au bulk containing a little amount of Ni atoms, and Ni phase was transformed into NiO phase completely.

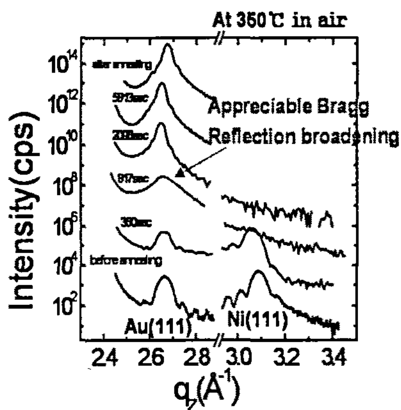

Fig. 1. *In situ* x-ray Bragg reflection profiles along the surface normal q_z direction for Ni(100Å)/Au(100Å) on *p*-type GaN during thermal oxidation in air