元素添加による窒化物薄膜の特性制御

～極性の制御から導電性の制御まで～

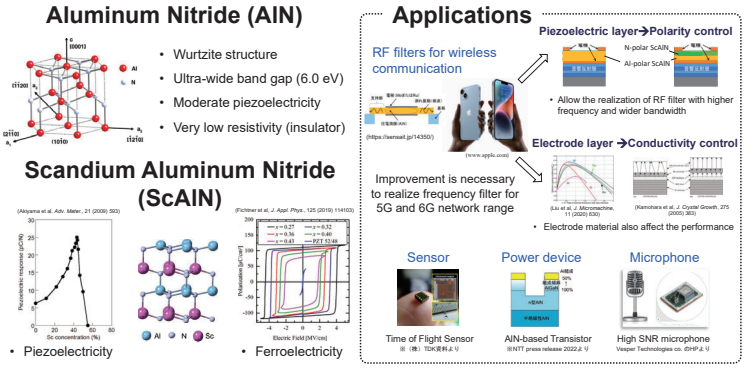
- ▶ 反応性スパッタリングを使ったによるウルツ鉱型窒化物の特性制御への元素添加
- ▶ 元素添加はウルツ鉱型窒化物の極性制御に有効
- ▶ ウルツ鉱型窒化物の導電性も元素添加による制御にも利用可能

Wurtzite Nitride thin films as the future materials

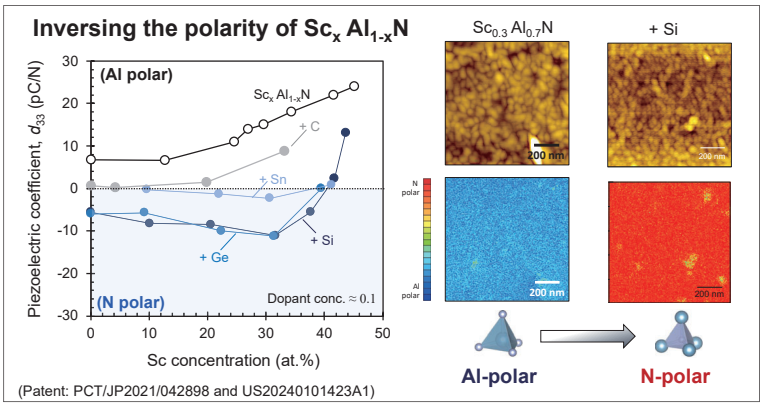
■ Wurtzite-structured AlN and ScAlN are promising materials for future next-generation electronic devices, including radio frequency (RF) filters.

■ Stacking Al-polar/N-polar piezoelectric thin films resulted in RF filter that can work at much higher frequency → Polarity control technology is important.

■ Electrode material also affects the performance of RF filter → Conductivity control technology is needed.



Polarity Control Technology



(Patent: PCT/JP2021/042898 and US20240101423A1)

■ Addition of element such as silicon (Si) or germanium (Ge) can be used to control the polarity of wurtzite nitride (AlN or ScAlN) thin films.

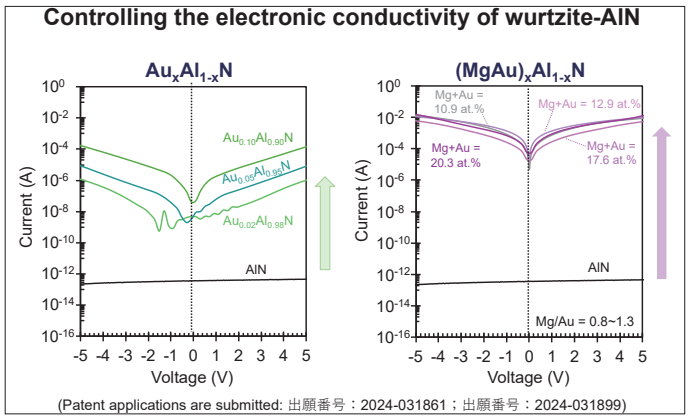
■ Addition of element that can promote the formation of cation vacancy (V_{Al}) is the key to control polarity.

■ Polarity control can be done not only by selecting the appropriate dopant but also by adjusting the concentration of the dopant as well as the concentration of Sc (In case of ScAlN).

Conductivity Control Technology

■ The electronic conductivity of wurtzite structured AlN (resistivity : 10^{14}~10^{10} Ωcm) can be improved by addition of element, such as Au or MgAu into AlN. The resulting resistivity of MgAuAlN at RT is 10^{-5} Ωcm.

■ The ratio and concentration of co-dopants or dopant is important to improve conductivity while simultaneously maintaining wurtzite structure.



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産総研
ともに挑む。つぎを創る。