FUJIOKA LAB.

[Future electronics by low-temperature epitaxial growth of semiconductors]

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Optoelectronic functional thin films

Department of Applied Chemistry

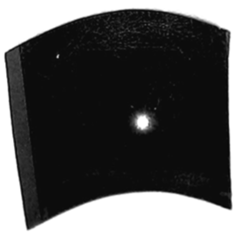
Future electronics by low-temperature crystal growth of semiconductors

Semiconductor devices are widely used as key components in telecommunication, information processing, and energy conversion systems. However, conventional semiconductor devices suffer from several problems such as high fabrication cost and fragility, which stem from the fact that single crystal wafers are used as starting materials in the fabrication processes. We are trying to solve these problems by growing semiconductor films on large-area flexible substrates.

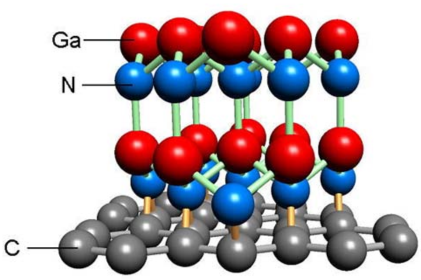
- ◆ Development of a low-temperature epitaxial growth technique
  A low-temperature epitaxial growth technique is necessary for fabrication of semiconductor devices on chemically vulnerable substrates. We have developed a new technique called pulsed excitation deposition (PXD) for this purpose, which makes it possible to grow semiconductor films even at room temperature.
- ◆ Epitaxial growth of semiconductors on flexible substrates
  We have succeeded in epitaxial growth of semiconductors on flexible substrates such as metals and graphite by the use of the PXD low-temperature growth technique.

Nitride semiconductor devices on graphite sheets

We have succeeded in the growth of high quality GaN films on graphite sheets, which allows us to fabricate high-efficiency energy conversion flexible devices such as light emitting diodes and solar cells.



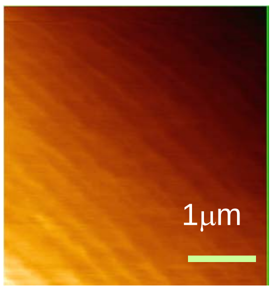
Luminescence from GaN grown on graphite sheets



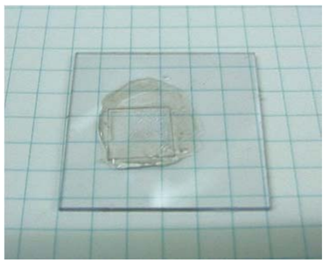
A schematic illustration of the atomic arrangement at the hetero-interface between GaN and graphite

Flexible semiconductor devices on large-grain metal sheets

Pseudo-single-crystalline metal films are available through a thermal or rolling process of metal foils. We have succeeded in the growth of high quality semiconductor films such as Si and GaN on them by the use of PXD low-temperature growth technique. Semiconductor films grown on the metal foils can be easily transferred onto various materials such as transparent polymers.



An AFM Surface image of nitride semiconductor films on metal foils



Transferred pseudo-single-crystalline GaN films from metal foils onto polymer sheets