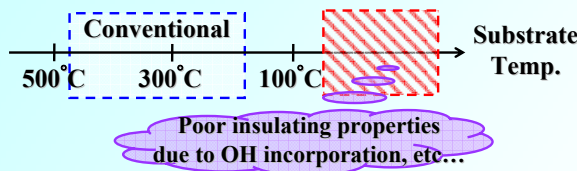


Thermally Stable Carbon-Doped Silicon Oxide Films Deposited at Room Temperature

1. Motivation

Low temperature deposition of silicon oxide (<100°C)

Necessary for heat-sensitive devices
(device integration on flexible plastics, TFT, etc...)

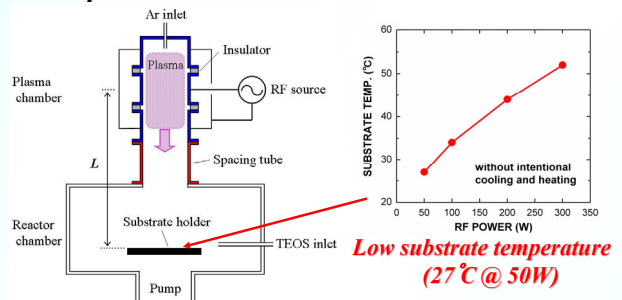


This Study

Room-temperature growth of silicon oxide by PECVD

- ✓ Remote PECVD using TEOS + Ar
→ **Low temperature & low damage process**
- ✓ Reduction of OH content by CH_n incorporation
→ **Improvement of insulating properties**

2. Experimental



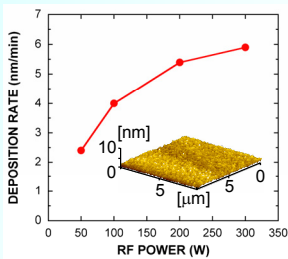
Remote PECVD system

- Annealing**
- ✓ 200–1000°C
- ✓ in vacuum (10⁻³ Pa)
- ✓ 1 hour

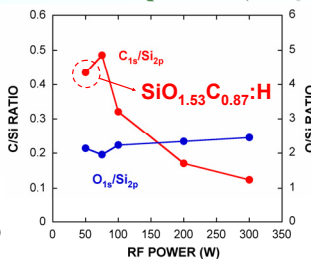
- ### Measurements
- ✓ XPS
 - ✓ AFM
 - ✓ FT-IR
 - ✓ I–V measurements (in N₂ ambient)

3. As-grown Silicon Oxide Films

Deposition Rate

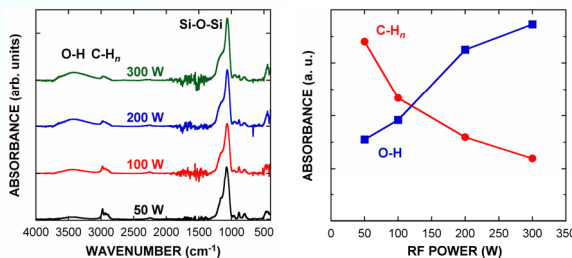


Film Composition (XPS)

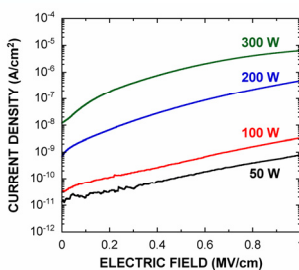


- ✓ **Smooth surface morphology (RMS~0.3 nm)**
- ✓ **Control of film composition by RF power**

Chemical Bonding Structure (FT-IR)



I–V Characteristics

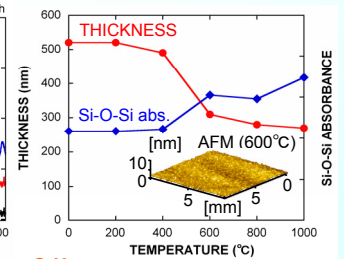
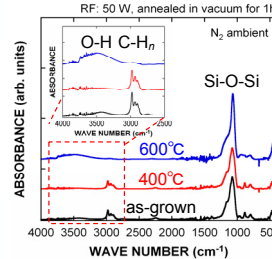


Low RF power

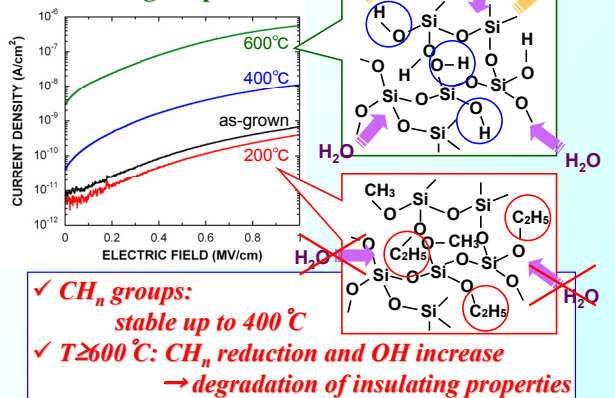
- ✓ **High CH_n content**
→ OH reduction
- ✓ **Low leakage current**
~10⁻¹⁰ A/cm² @ 1 MV/cm

4. Thermal Stability of the Films

Structural Change



Insulating Properties



- ✓ **CH_n groups:**
stable up to 400°C
- ✓ **T ≥ 600°C:** CH_n reduction and OH increase
→ degradation of insulating properties

5. Conclusions

We have succeeded in growth of the silicon oxide with high resistivity by PECVD using TEOS at 27°C.

- ✓ Carbon incorporation by deposition at low RF power improved their insulating properties.
- ✓ CH_n groups contained in the SiOCH films were thermally stable up to 400°C.