**Advantage of Photosensitive Low-k**

- Multilevel interconnect integration with low-k dielectric film (LKD).
- Improvement of EB exposed pattern.
- Merits:
  - Dryetch-less process
  - Solution to dryetching problem

**Strategy**

Photosensitive LKD: TODAY’S PRESENTATION.

**Purpose**

Photosensitive Porous Low-k Interlayer Dielectric Film

**Purpose**

- Novel Photosensitive Porous Low-k Interlayer Dielectric Film with low-k dielectric film (LKD).
- Multilevel interconnect integration

**Problem of damascene fabrication**

- By dryetching and ashing.

**Process Flow**

- Photosensitive MSQ
- Base polymer: MSZ-MSQ
- PAG: TAZ-104 (Midori Kagaku)

**SEM Micrographs**

- EB energy: 50 kV, EB exposure dose: 9.0 µC/cm²
- Base polymer: MSZ-MSQ
- PAG: TAZ-104 (Midori Kagaku)

**Summary**

A novel photosensitive porous MSQ interlayer dielectric film was developed. Photosensitive porous MSQ (20 wt% porogen) had porosity 17 % and pore radius of 2.03 nm, and dielectric constant of 2.73.

**Acknowledgement**

Part of this work was supported by NEDO under the management of ASET in METI’s R&D.

**Material & Film Formation**

Photosensitive MSQ

Electron-Beam Exposure + PAG: TAZ-104 (Midori Kagaku)

Chemical Amplified Reaction

**Electron-Beam Sensitivity**

- Exposure depth versus exposure dose
- EB energy: 50 kV
- With & without porogen

Although porogen additives decreased the photosensitivity, the 200 nm line and space patterns were successfully exposed. The critical exposure dose for photosensitive MSQ was at 200 nm design size was 550 µC/cm².

**Feature size versus exposure dose**

- EB energy: 50 kV
- With & without porogen

**Film characterization**

- Porosity: Spectroscopic ellipsometry
- Dielectric constant: CV measurements
- Pore radius distribution: X-ray scattering measurements

**Merits**

- Decrease of hardmask and etch-step layer
- Improvement of dryetching step
- Solution to dryetching problem

- Dryetch-less process

**SEM Micrographs**

- EB energy: 50 kV, EB exposure dose: 9.0 µC/cm²
- Base polymer: MSZ-MSQ
- PAG: TAZ-104 (Midori Kagaku)

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September 17, 2003, Tokyo, JAPAN.