Study for RRAM based on C-PVA doped with RGO (fabrication and switching mechanism)

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Outlines

Introduction
  ▪ RRAM characterization

Experimental details
  ▪ Fabrication

Results and discussion
  ▪ Switching mechanism
Introduction—RRAM characterization

What is RRAM?

- Structure & operating mechanism

Two kinds of RRAM

- Bipolar RRAM & Unipolar RRAM

To be ideal RRAM

- Checking voltage and resistance

What is RRAM?

- Should have small power consumption and small physical size
- Should have good retention, endurance and program/erase speed

Checking voltage and resistance

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Experimental details _ fabrication

1. BE layer
   ITO

2. Insulator layer (Spin coating)
   C-PVA(2[wt%]) + RGO(0.05mg/ml)

3. TE layer
   (Thermal evaporation via shadow mask)
   Al

Trying many volume ratio of C-PVA:RGO
>1:1, 1:3, 1:5, 1:10, 1:13, 1:15

RGO ratio of C-PVA+RGO

Density of C-PVA+RGO
Results and discussion

- 0~10 volt, compliance current 1mA
- 0~5 volt, compliance current -5mA

**C-PVA:RGO=1:1**

**C-PVA:RGO=1:3**

**C-PVA:RGO=1:5**

**C-PVA:RGO=1:10**

**C-PVA:RGO=1:13**

**C-PVA:RGO=1:15**

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- C-PVA:RGO=1:15
Results and discussion

Set/Reset voltage

- Insulator becomes thinner
- Set/rest voltage smaller
- HRS resistance smaller

HRS/LRS resistance

Event Factor of C-PVA + RGO

- Filament connection well
- Yields ideal
- Operating cycles down

Maximum number of yields

Maximum number of operating cycles

C-PVA : GO

C-PVA : RGO
Results and discussion_ switching mechanism

- In(I/V) ≈ 1
- The trapped charges follow Ohm’s law, as depicted by the slope (~1) of the initial part of curve

- In(I/V) ≈ 2
- At a higher voltage, the charge transport is restricted by SCLC (space charge limited conduction), governed by Child’s law

\[ J = \frac{9}{8} \varepsilon \varepsilon_0 \mu \frac{V^2}{L^3} \]
Thank You