

**ReRAM is Real**

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**Panasonic Corporation**

# ReRAM

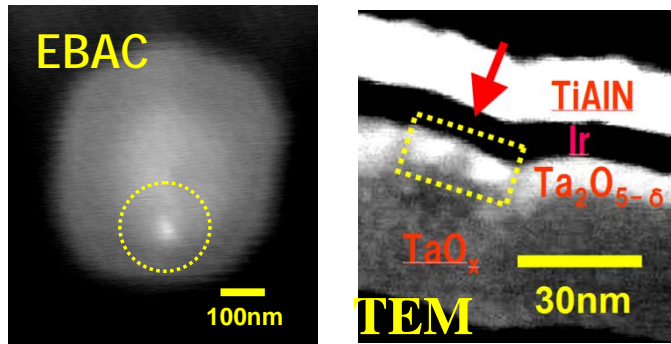
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- **Mechanism is still unclear**
- **Any oxide is switchable**
- **Emerging Memory**

# Switching Model for ReRAM

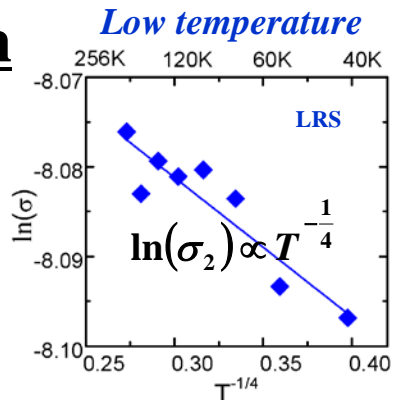
- Active area → One filament in the  $Ta_2O_{5-\delta}$  layer
- Conduction → Electron hopping via oxygen vacancies
- Switching → The change of the density of  $V_o$

## Active Area One filament



## Conduction

Electron hopping via  $V_o$



IEDM 2011

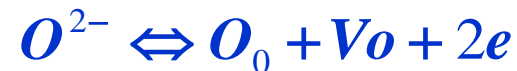
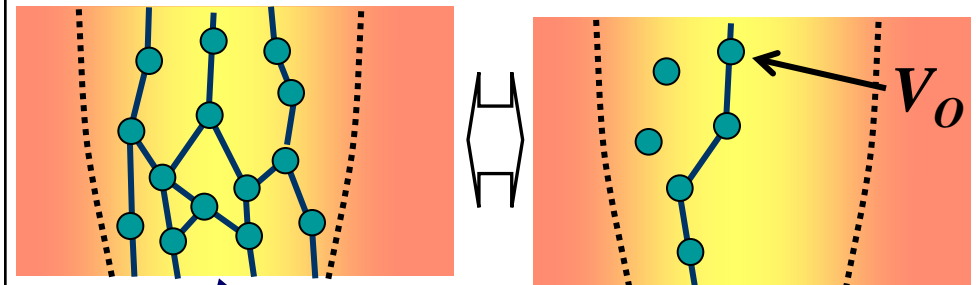
## Switching

Oxygen Vacancy Migration

LRS

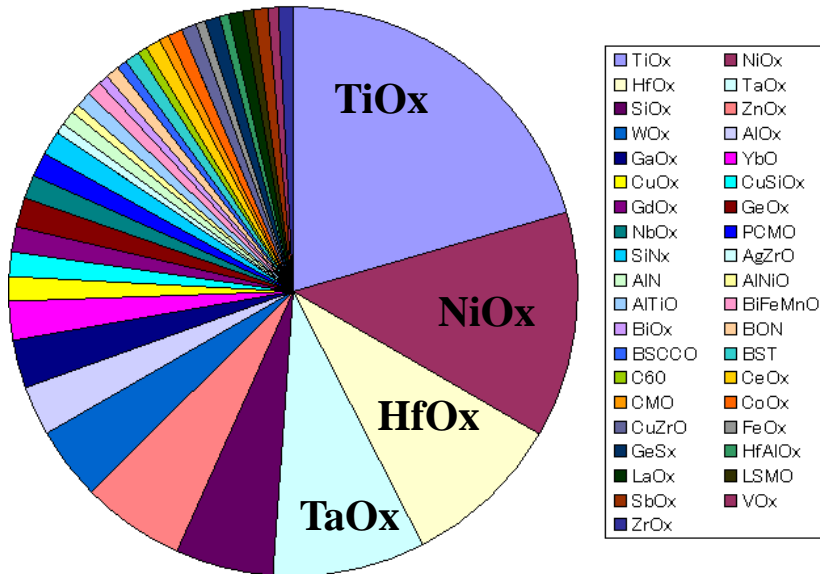
HRS

CF

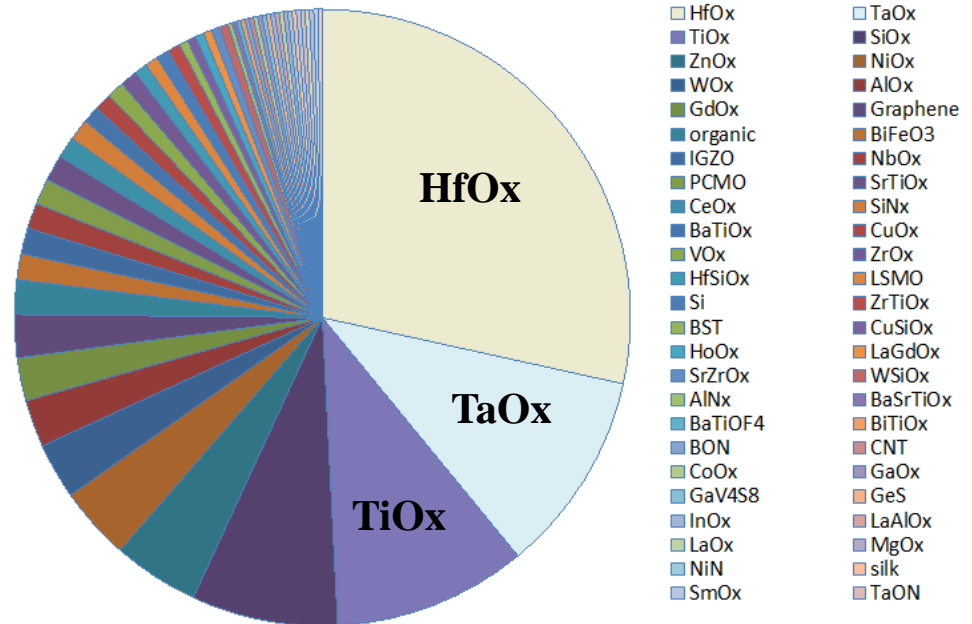


# Materials for ReRAM

- Various materials show resistance switching
- Number of TaOx-paper rises to No.2 in 2013



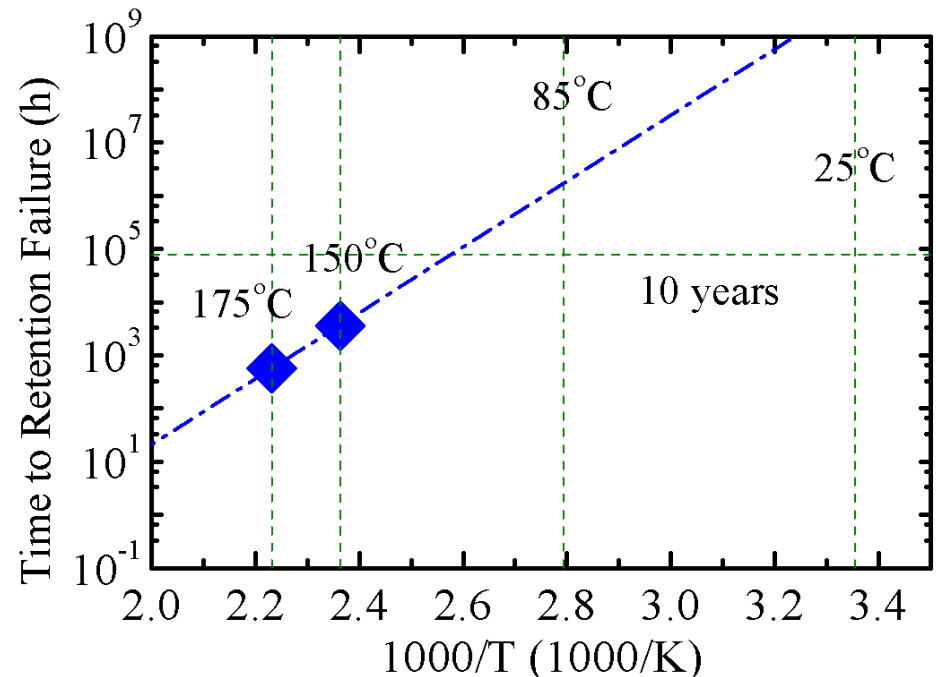
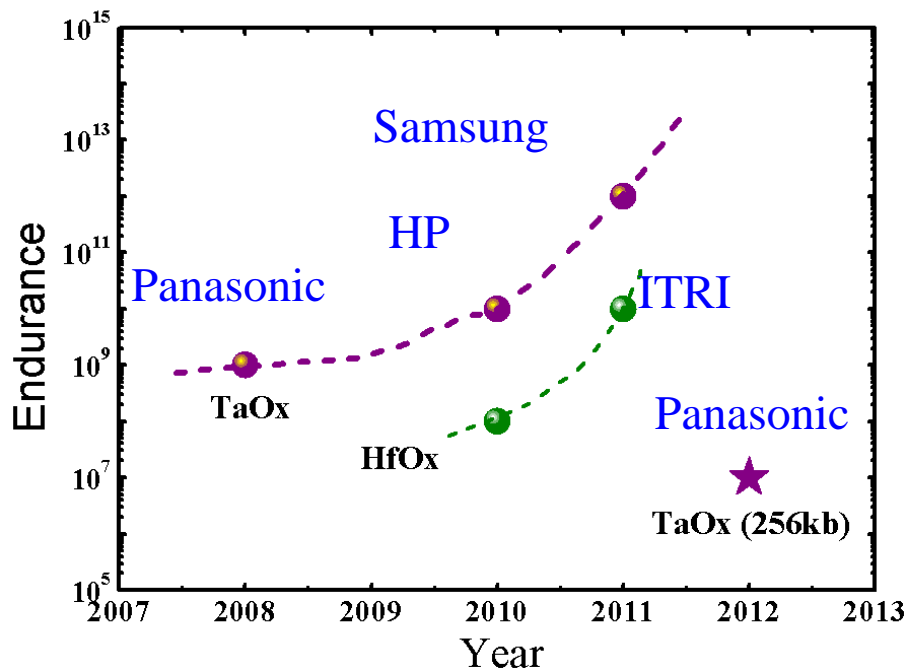
(Google scholar 2012.1-2012.12)



(Google scholar 2013.1-2013.12)

# TaO<sub>x</sub> ReRAM

- Long Endurance Capability of TaO<sub>x</sub> ReRAM
- Retention period of the 256-kbit array including tail bits is more than 10 years at 85°C.



# ReRAM in the market

**Panasonic has started world's first mass-production of ReRAM-embedded MCU since August 2013.**

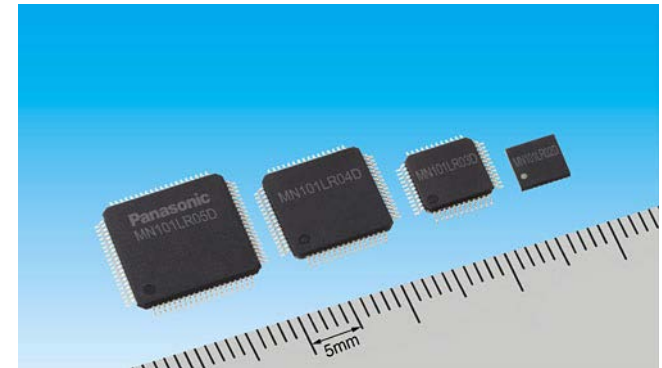
Jul 30, 2013

## Panasonic Starts World's First Mass Production of ReRAM Mounted Microcomputers

[About Panasonic](#) [Media Contacts](#)

**Osaka, Japan** - Panasonic Corporation today announced that it will start the world's first\*1 mass-production of microcomputers with mounted ReRAM [1], a type of non-volatile memory, in August 2013. Through utilizing microcomputers with mounted ReRAM, it will be possible to achieve high-speed rewriting and longer operational times in battery-powered equipment, such as portable devices and security devices etc.,

*Panasonic will start mass production in August 2013 of the ReRAM mounted microcomputers, contributing to longer operational times for security, portable and energy harvesting equipment with low power consumption.*



**Panasonic Corp. press release**

**We hope much further spread of ReRAM in the market!**

# Summary

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- ~~• Mechanism is still unclear~~

Redox Reaction in Filament near Anode

- ~~• Any oxide is switchable~~

TaOx ReRAM shows high reliability

- ~~• Emerging Memory~~

ReRAM is in the market