PRAM

THÀNH VIÊN:

- TRẦN NGỌC HIẾU
- TRẦN MINH HẢI
- NGUYỄN TRUNG THOẠI
- NGUYỄN TRÚC MAI
- NGUYỄN HỮU THIỆN
- PHẠM MINH THUẬN

I- GIỚI THIỆU

- What is PRAM?
  - The abbreviation of Parameter random access memory.
  - The PRAM is classified into the Phase – Change Memory (PCM).
  - The Parameter RAM is a small amount of "nonvolatile" RAM (NVRAM) that holds various settings that the system can use before the operating system loads, and maintains these settings even when the computer is turned off.
  - There is a small battery on the computer's mainboard that helps maintain the PRAM settings when power is off.

I- GIỚI THIỆU

- What is the Phase – Change Memory?
  - In the 1960s, Stanford R. Ovshinsky of Energy Conversion Devices first explored the properties of chalcogenide glasses as a potential memory technology.
  - In 1969, Charles Sie published a dissertation at Iowa State University that both described and demonstrated the feasibility of a phase-change-memory device by integrating chalcogenide film with a diode array.
  - A cinematographic study in 1970 established that the phase-change-memory mechanism in chalcogenide glass involves electric-field-induced crystalline filament growth.

I- GIỚI THIỆU

- Structure:
  - PRAMs exploit the unique behaviour of chalcogenide glass.

- Chalcogenide glass is a glass containing one or more chalcogens (sulfur, selenium and tellurium, but excluding oxygen).
  - Chalcogenide compounds such as AgInSbTe and GeSbTe are used in rewritable optical disks and phase-change memory devices
  - By controlling heating and annealing (cooling), they can be switched between an amorphous and a crystalline state.

- Material Used is called **CHALCOGENIED.**
- The Group VI elements of the periodic table.
- Refers to alloys containing at least one of these elements such as the alloy of Germanium, Antimony, and Tellurium…

I- GIỚI THIỆU

- Structure:
  - In the older generation of PCM, heat produced by the passage of an electric current through a heating element generally made of TiN was used to either quickly heat and quench the glass, making it amorphous, or to hold it in its crystallization temperature range for some time, thereby switching it to a crystalline state.
  - Newer PCM technology
    - To find viable material alternatives to $Ge_2Sb_2Te_5$ (GST), with mixed success.
    - The use of a GeTe - Sb_2Te_3 superlattice to achieve non-thermal phase changes by simply changing the co-ordination state of the Germanium atoms with a laser pulse.
  - This new Interfacial Phase-Change Memory (IPCM) has had many successes and continues to be the site of much active research.

I- GIỚI THIỆU

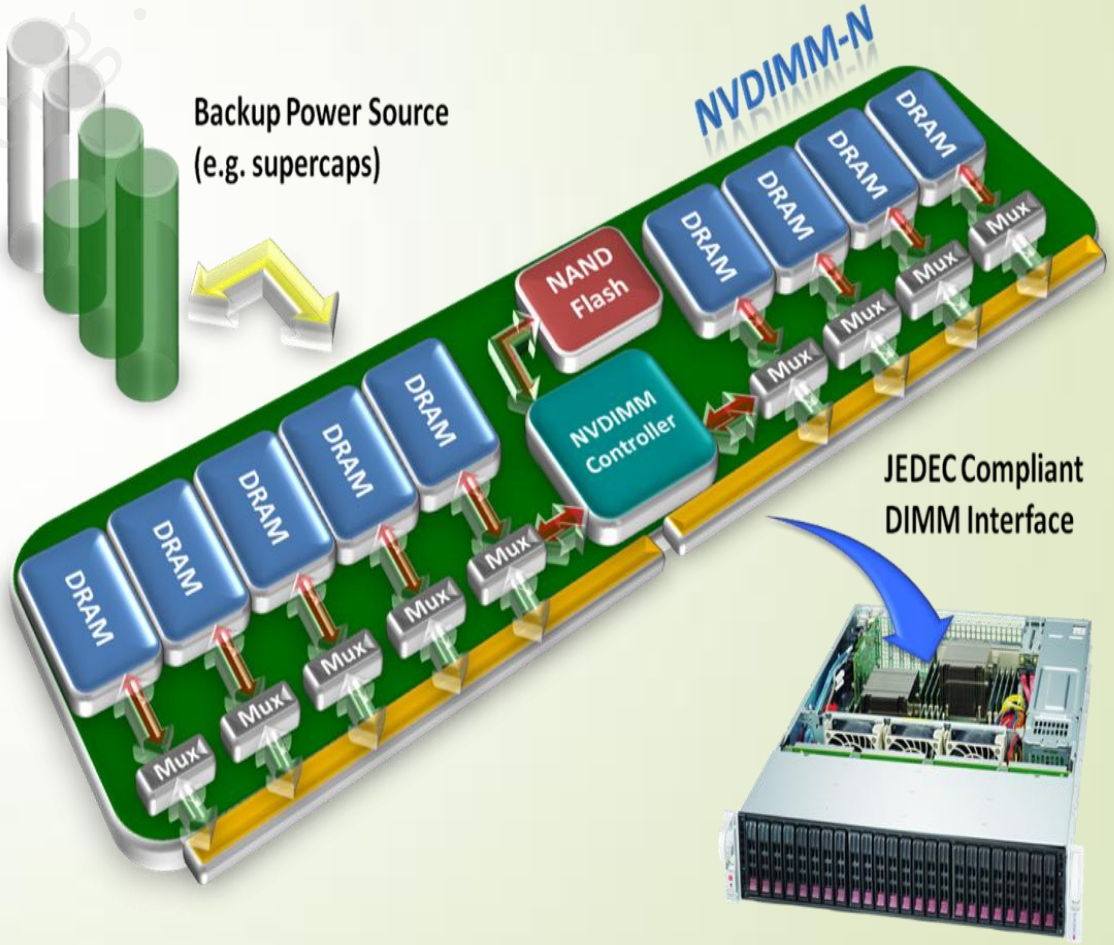
- Structure:
  - The crystalline and amorphous states of chalcogenide glass have dramatically different electrical resistivity values. The amorphous, high resistance state represents a binary 0, while the crystalline, low resistance state represents a 1.
  - The stoichiometry or Ge:Sb:Te element ratio is 2:2:5. When GST is heated to a high temperature (over 600 C), its chalcogenide crystallinity is lost. Once cooled, it is frozen into an amorphous glass-like state and its electrical resistance is high. By heating the chalcogenide to a temperature above its crystallization point, but below the melting point, it will transform into a crystalline state with a much lower resistance.
  - The time to complete this phase transition is temperature-dependent. Cooler portions of the chalcogenide take longer to crystallize, and overheated portions may be remelted. A crystallization time scale on the order of 100 ns is commonly used.

I- GIỚI THIỆU

- What is its function?
  - The PRAM held information for networking, but that has been removed so any network troubles should not be affected by PRAM settings.
  - If you have problems with any of the following then a PRAM reset might help you out:
    - Volume changes or won't stick
    - Video resolutions not sticking or not all available
    - Time zone information and clock settings
    - Boot volume isn't set (question mark shows briefly before booting)
    - Keyboard repeat rates
    - Mouse input rates (click and tracking speeds)
    - Default system fonts

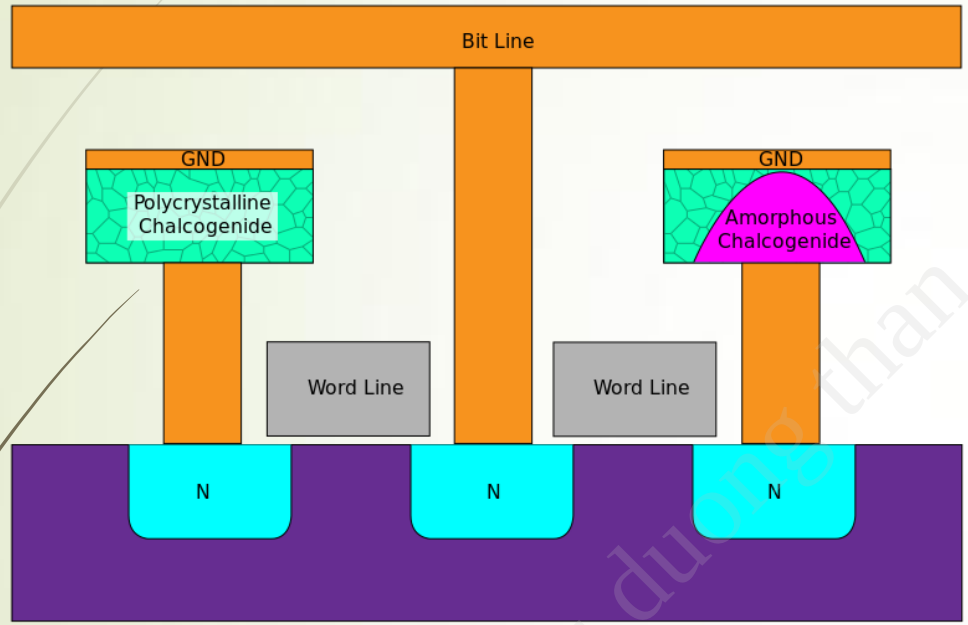
I- GIỚI THIỆU

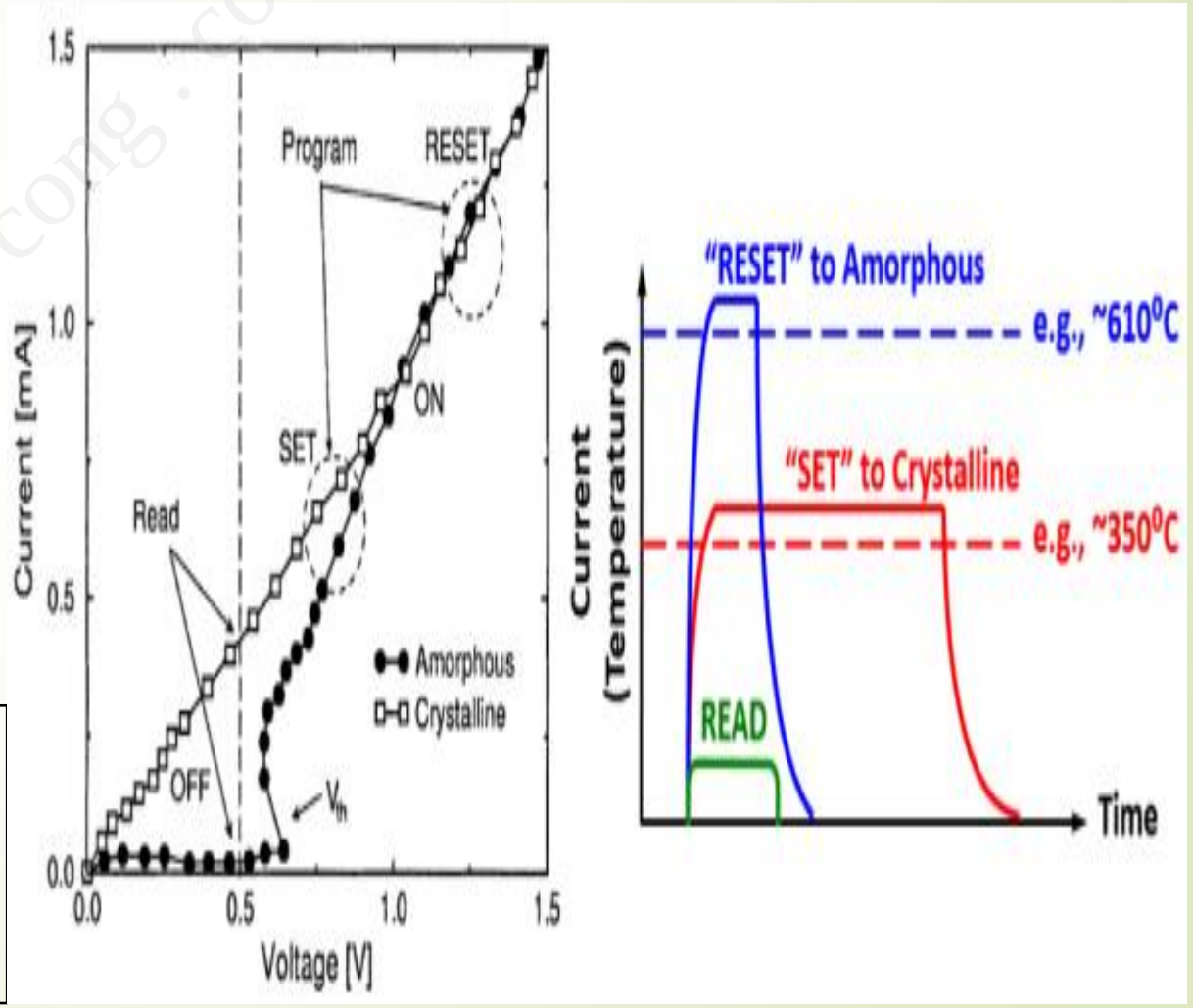
- What is its function?
  - Because it is much closer in speed to dynamic RAM (DRAM), phase change memory technology is ideal for both non-volatile dual in-line memory modules (NVDIMMs) and non-volatile memory express (NVMe) solid state drives (SSDs).



- What is its function?
  - Apart from its speed advantage, phase change memory technology is also much more durable than flash, and any concern about the number of daily writes causing wear-out is not an issue. PCM is sometimes called "perfect RAM" (PRAM) because data can be overwritten without having to erase it first.

II- CẤU TẠO – NGUYÊN LÝ HOẠT ĐỘNG

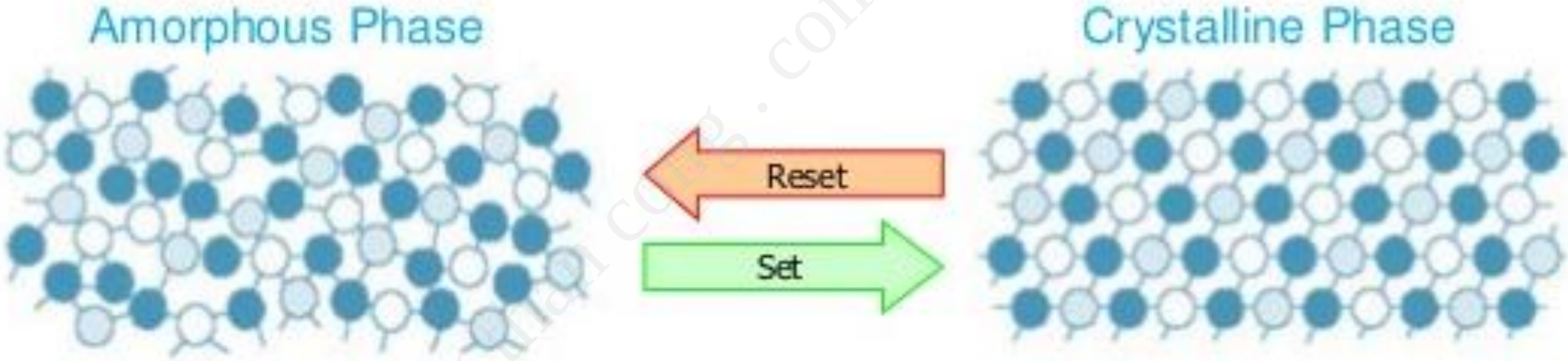




- The amorphous, high resistance state represents a binary 0,
- While the crystalline, low resistance state represents a 1.

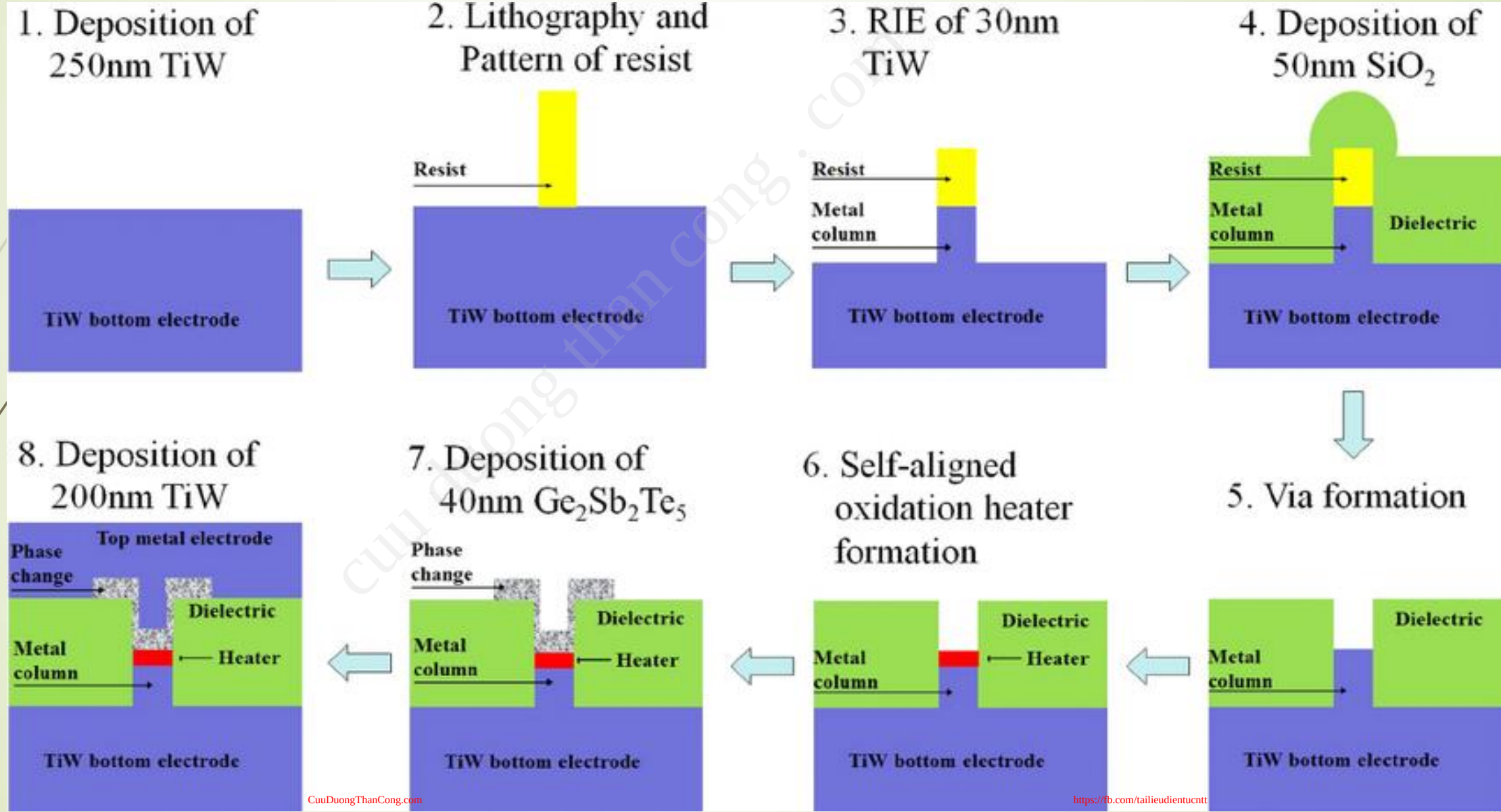
II- CẤU TẠO – NGUYÊN LÝ HOẠT ĐỘNG

- Two Phases:



- Phases have *very* different electrical resistances (ratio of 1:100 to 1:1000)
- Transition between phases by controlled heating and cooling
- Read time: 100-300 nsec
- Program time: 10-150 µsec
- PCM cells can be reprogrammed at least 10^6 times
- Performance and price characteristics between DRAM and Flash

III- CHẾ TẠO



IV- ĐẶC ĐIỂM

Attributes	PCM	EEPROM	NOR	NAND	DRAM
Non-Volatile	Yes	Yes	Yes	Yes	No
Scalability	<10 nm	~4x	~3x nm	~1x nm	~2x nm
Bit Alterable	Yes	Yes	No	No	Yes
Erase Required	No	No	Yes	Yes	No
Software	Easy	Easy	Moderate	Hard	Easy
Write Speed	~100 MB/s	~30 KB/s	~1 MB/s	~20 MB/s	~1 GB/s
Read Speed	50 - 100 ns	~200ns	70-100 ns	15-50 µs	20 - 80 ns
Endurance	$10^{6◊8}$	10^{5-6}	10^{5}	10^{4-5}	Unlimited

IV- ĐẶC ĐIỂM

- PRAM's temperature sensitivity is perhaps its most notable drawback, one that may require changes in the production process of manufacturers incorporating the technology.
- PRAM's high performance, thousands of times faster than conventional hard drives, makes it particularly interesting in nonvolatile memory roles that are currently performance-limited by memory access timing.
- PRAM devices also degrade with use, for different reasons than Flash, but degrade much more slowly. A PRAM device may endure around 100 million write cycles.
- PRAM lifetime is limited by mechanisms such as degradation due to GST thermal expansion during programming, metal (and other material) migration, and other mechanisms still unknown.
- The contents of a PRAM, however, are lost because of the high temperatures needed to solder the device to a board. This is made worse by the recent drive to lead-free manufacturing requiring higher soldering temperatures. The manufacturer using PRAM parts must provide a mechanism to program the PRAM "in-system" after it has been soldered in place.
- PRAM devices originally stored only a single bit in each cell, but Intel's recent advances have removed this problem.
- PRAM cell selectors can use various devices: diodes, BJTs and MOSFETs.