

# Phase-change memory

## New material for PRAM with thermal stability

### Summary

A phase-change material, which has a high crystallization temperature and is superior in thermal stability of the amorphous phase, which has a composition of the general chemical formula  $\text{Ge}_{x\text{MyTe}_{100-x-y}}$  wherein M indicates one type of element which is selected from the group which comprises Al, Si, Cu, In, and Sn, x is 5.0 to 50.0 (at %) and y is 4.0 to 45.0 (at %) in range, and x and y are selected so that  $40 \text{ (at \%)} \leq x+y \leq 60 \text{ (at \%)}$ . This phase-change material further contains, as an additional element L, at least one type of element L which is selected from the group which comprises N, O, Al, Si, P, Cu, In, and Sn in the form of  $\text{Ge}_{x\text{MyLzTe}_{100-x-y-z}}$  wherein z is selected so that  $40 \text{ (at \%)} \leq x+y+z \leq 60 \text{ (at \%)}$ .

### Effect/Application

Phase-change memory

## Patent Data Sheet

8,598,563 (US)、1333751 (KR)、201080040813.3 (CN)、5403565 (JP) (T09-087)

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### Characteristics

Invention	Te (at.%)	Ge (at.%)	M (: Al, Si, Cu, Zn, In, Sn) (at.%)	Additional Element	Crystallization Temperature	Activation energy	Melting Temperature	Electrical resistivity
					※1	※1	※2	※3
	残部	47.5	Al: 5.0		222	3.1	690	$7 \times 10^8$
	"	45.0	Al: 11.0	-	262	3.3	705	$7 \times 10^8$
	"	46.0	Al: 6.0	Sn: 1.0	230	3.6	695	$5 \times 10^8$
	"	44.2	Al: 10.2	In: 0.5	270	3.3	708	$6 \times 10^8$
	"	45.2	Si: 10.2	-	291	3.5	690	$9 \times 10^8$
	"	44.2	Si: 10.1	O: 0.5	298	3.7	700	$1 \times 10^9$
	"	40.5	Cu: 8.0	-	230	3.3	570	$2 \times 10^8$
	"	23.8	Cu: 17.1	-	202	3.3	512	$4 \times 10^8$
	"	20.4	Cu: 29.1	-	208	3.4	541	$2 \times 10^8$
	"	16.7	Cu: 33.3	-	200	3.4	542	$3 \times 10^8$

GeSbTe

ex) Ge:22.2%, Sb22.2%, Te Rest

159	2.3	640	$3 \times 10^8$
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※1 : To keep thermal stability, Large Crystallization Temperature & Activation energy are better

※2 : Low is better

※3 :  $10^8$  is needed for "Read Accuracy"

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