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Improved thermal stability and retention properties of Cu-Te based CBRAM by Ge alloying

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Table S1: Compositions of the prepared samples determined by RBS or XRF.

Sample	Technique	Cu (at%)	Te (at%)	Ge (at%)
$Cu_{0.6}Te_{0.4}$	XRF	59.6	40.4	/
CuTeGe5	XRF	58.9	35.6	5.5
CuTeGe10	RBS	54.9	33.4	11.7
CuTeGe20	RBS	49.7	30.6	19.7
CuTeGe30	XRF	44.2	27.3	28.5
CuTeGe40	XRF	39.6	24.3	36.1
CuTeGe50	XRF	31.7	19.1	49.2
Cu_2GeTe_3	XRF	32.7	50.3	17
Cu_2GeTe_3 Te rich	XRF	29.5	56.9	13.6
Cu_2GeTe_3 Te poor	XRF	37.5	44.5	18

Table S2: Composition of the Te rich and Te poor Cu_2GeTe_3 layers before and after anneal at 400°C, determined by XRF.

Sample	Cu content (at%)	Ge content (at%)	Te content (at%)
Cu_2GeTe_3 Te rich as deposited	29.5	13.6	**56.9**
Cu_2GeTe_3 Te rich anneal 400°C	33.6	15.4	**51**
Cu_2GeTe_3 Te poor as deposited	37.5	18	44.5
Cu_2GeTe_3 Te poor anneal 400°C	37.3	18.3	44.4

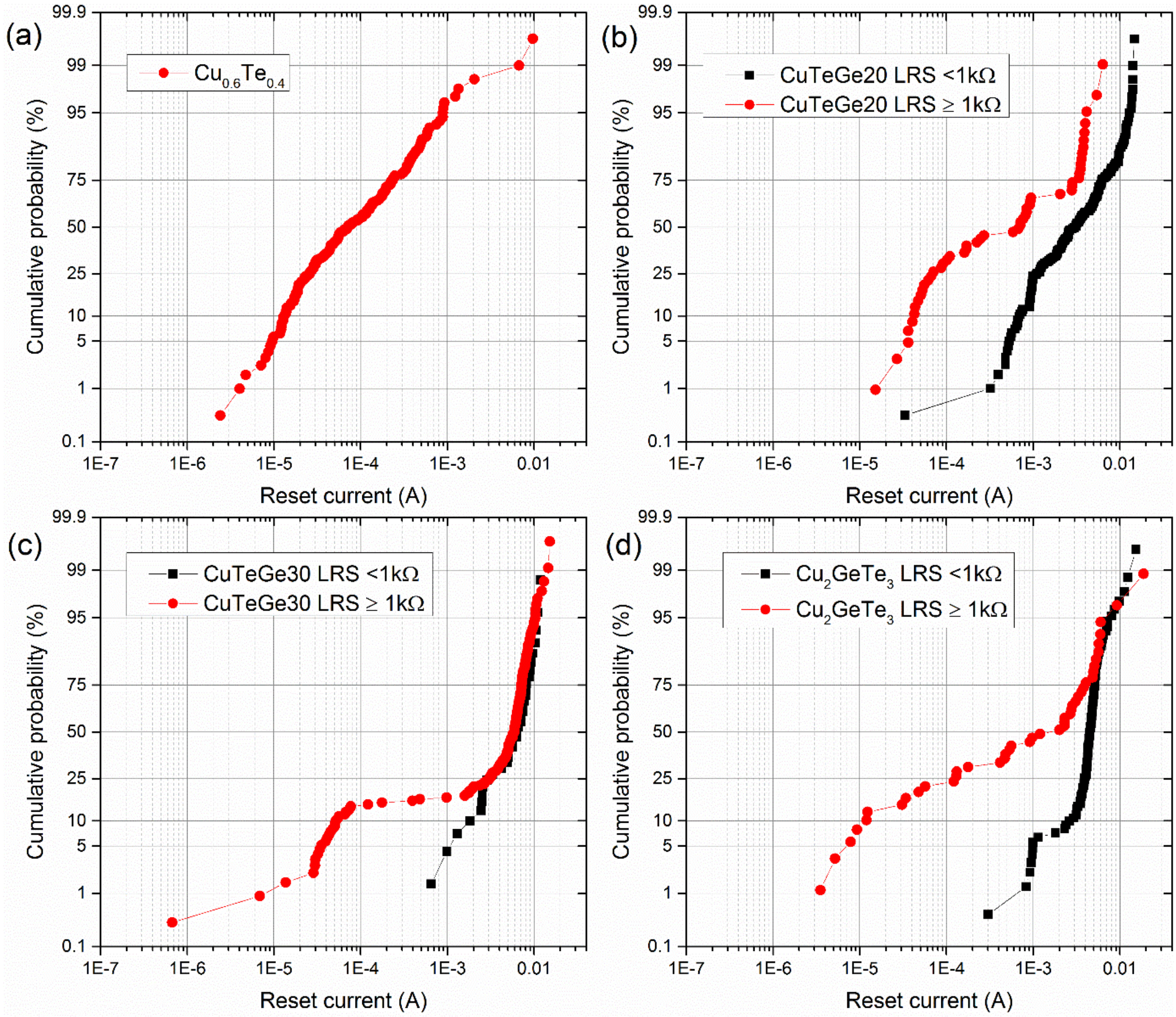

Figure S1: Cumulative probability of the reset currents for (a) $Cu_{0.6}Te_{0.4}$, (b) CuTeGe20, (c) CuTeGe30 and (d) Cu_2GeTe_3 based CBRAM cells. All LRS resistances are larger than 1kΩ in (a). For (b)-(d) the reset currents of filaments with LRS resistances smaller than or larger than 1kΩ are represented separately. A larger fraction of the reset operations show higher reset currents for the Ge containing supply layers.

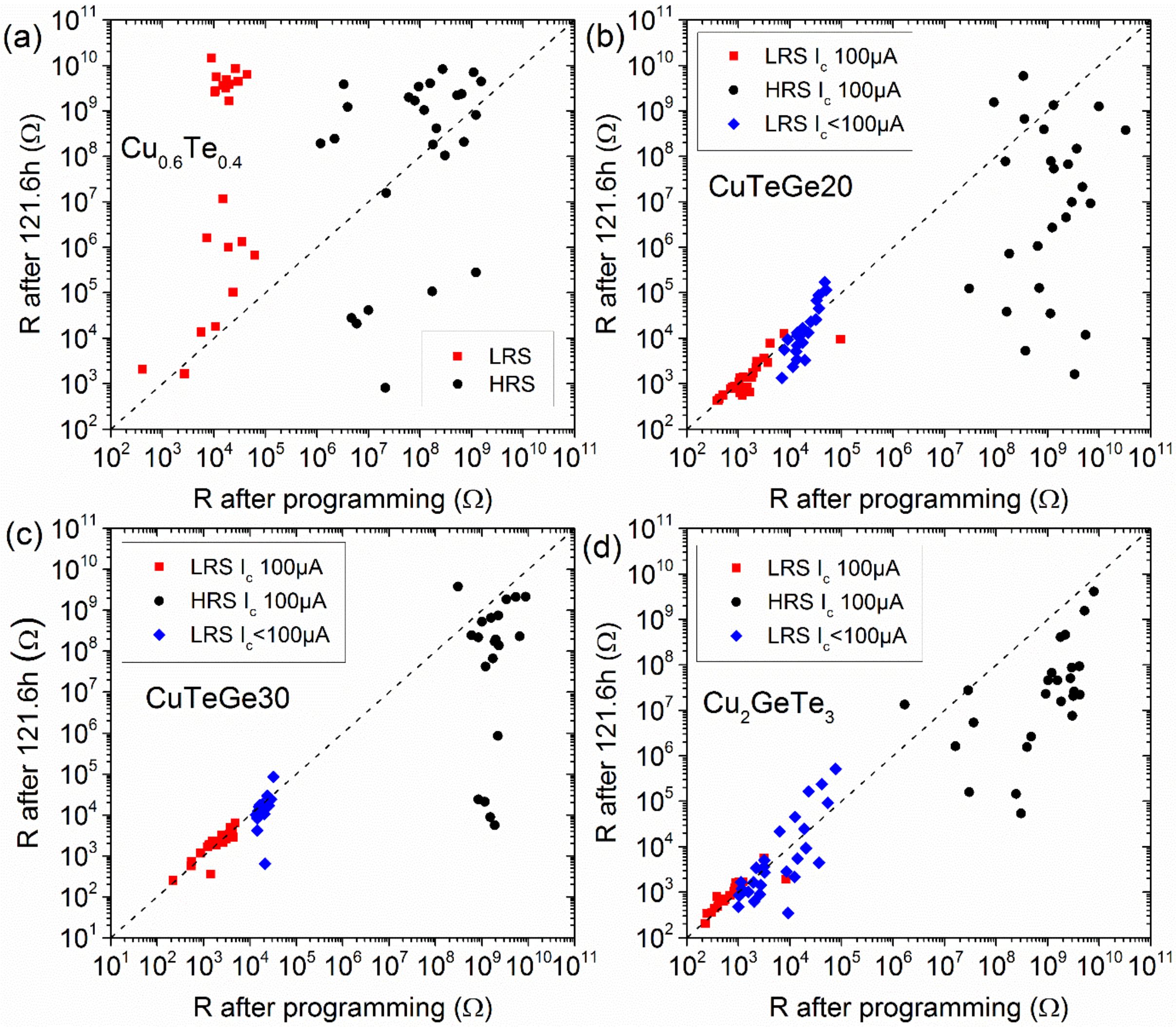

Figure S2: Resistance after 121.6 hour baking at 85°C as a function of the resistance after programming for memory cells with (a) $Cu_{0.6}Te_{0.4}$, (b) CuTeGe20, (c) CuTeGe30 and (d) Cu_2GeTe_3 as Cu supply layer.