

• Supplementary File •

## Spin logic operations based on magnetization switching by asymmetric spin current

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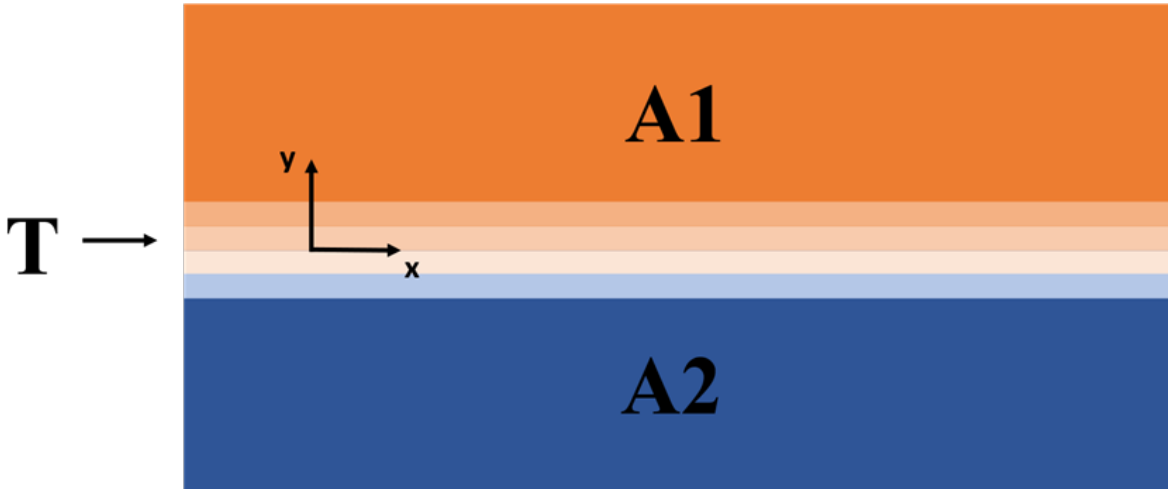
### Appendix A Simulation parameters and details

Micromagnetic simulations was performed by MuMax3 [1]. We separated the device with 3 areas in simulation, which is shown Figure A1, the colors represent spin polarization. We set A1 area and A2 area with different electrical current polarization, which is listed in Table1. The T area (transition area) with 4nm width is in the middle of the A1 area and A2 area. In the T area, the polarization of cells in one row is the same, and we set the polarization of the cells in column changing with the distance along y axis. The difference of the polarization between adjacent cells along y axis in T area is 0.2.

**Table A1** Simulation parameters

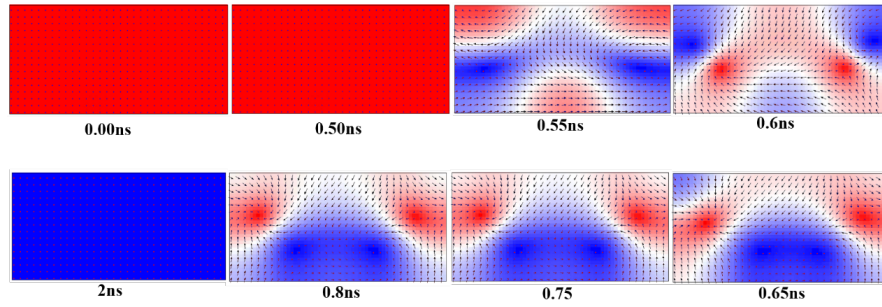
Parameter Description	Description	Values
FM Layer Dimensions	Length × Width × Thickness	64nm × 32nm × 1nm
Cell size	Length × Width × Thickness	1nm × 1nm × 1 nm
$\alpha$	Gilbert damping factor	0.03
A	Exchange constant	$5 \times 10^{11} J/m$
Ms	Saturation magnetization	$1.4 \times 10^6 A/m$
Ku1	1st order uniaxial anisotropy constant	$1.5 \times 10^6 J/m^3$
Pol (+y sides)	Electrical current polarization	-0.6
Pol (y sides)	Electrical current polarization	0.4
epsilonprime	Slonczewski secondary STT term	0

Snapshots of magnetization profiles under the asymmetric spin current is shown in Figure A2.



**Figure A1** Schematic illustration of areas in simulation.

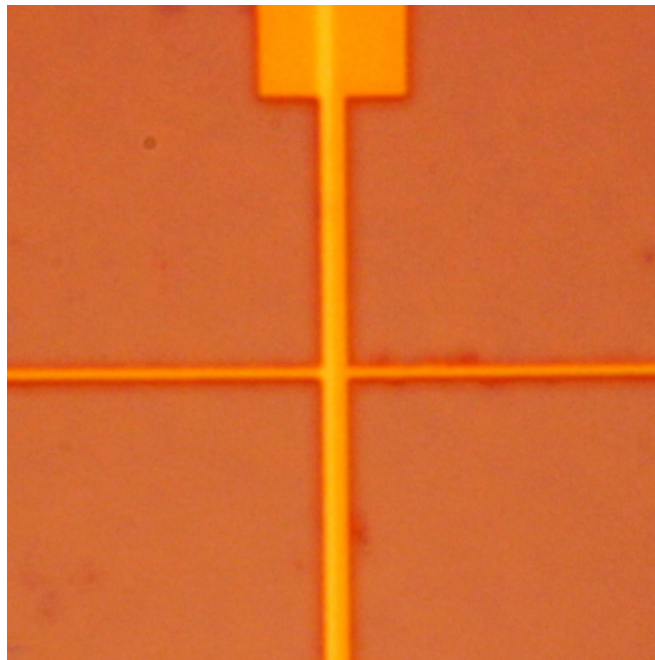
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**Figure A2** Snapshots of magnetization profiles under the asymmetric spin current

## Appendix B Optical microscopy image of a device

Figure.B1 show the optical microscopy image of a device.



**Figure B1** Optical microscopy image of the device

## References

- 1 Vansteenkiste A, Leliaert J, Dvornik M, et al. The design and verification of MuMax3. *AIP Adv*, 2014, 4: 107133