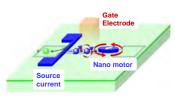
Spin Device

Spin Motor and Spin Rotary Member

Prof. Atsufumi HIROHATA(York University)

1. Novel Mechanism: Nano-Spin Motor

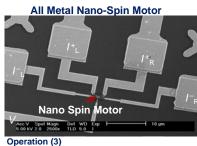
- A magnetic moment in the ferromagnetic nano-disk rotates by the spin-polarized current flowing from the non-magnetic material under the disk.
- High efficiency and high rotation frequency are expected.

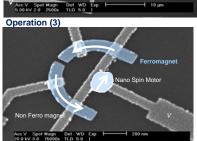


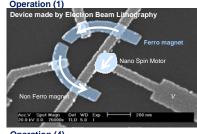
	Conventional	This invention
Rotation Frequency	Hz ~ KHz	Hz ~ GHz
Device size	100µm ~ mm	100nm ~ μ m

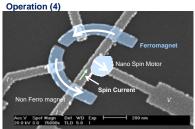
Position of the Nano Spin motor Nano Spin Motor Conventional motors Well page 100 MHz Conventional motors Well page 100 MHz Flagellar motor Mems / Nems motors Electromagnetic Flagellar motor Motor size [m]

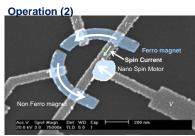
2. Structure and Operation Principle

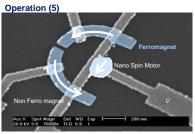






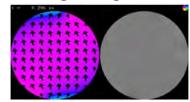


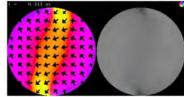


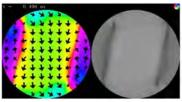


3. Simulation (Now, under an demonstration stage)

Rotation images of the magnetic moment: Simulation has been executed by using the LLG equation. Left: model diagram Right: differential image of the magnetic domain







Landau-Lifshitz Gilbert Equation $$\begin{split} &\frac{d\hat{m}}{dt} = -\frac{|\gamma|}{1+\alpha^2} \{ \widehat{m} \times \overrightarrow{H}_{Tot} + \alpha \widehat{m} \times (\widehat{m} \times \overrightarrow{H}_{Tot}) \} \\ &\overrightarrow{H}_{Tot} = \overrightarrow{H}_{eff} + \overrightarrow{H}_{ST} \qquad (\overrightarrow{H}_{ST} : \text{Spin-Torque field}) \\ &\overrightarrow{H}_{ST} = -gA_{SL} \times \{ \widehat{m}_p \times \widehat{m} + \beta \widehat{m}_p \} \\ &\overrightarrow{H}_{eff} = -\frac{1}{M_S} \frac{\partial B}{\partial \widehat{m}} \end{split}$$

4. Potential Applications



Patent Licensing Available Patent No.: WO2014/024697

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