Magnetic memory cells for computers

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Memory devices store information in electronic devices such as computers. The recent progress in the information technology increases the amount of the information which is stored in the memory devices. Therefore, it is necessary to develop future memory devices which have the potential for nonvolatility, high speed, low operating voltage and unlimited endurance. The semiconductor memory devices do not have such potential, and there is no memory device with above potential except magnetic random access memories (MRAMs). The MRAMs store information as magnetization directions of magnetic memory cells. From the viewpoint of a storage density, the memory cells should be small and arranged at a high density as same as the other semiconductor memory devices. However, the high density arrangement of the memory cells enhances the magnetic interaction between adjacent memory cells because the memory cells cause stray fields. In order to reduce the effects of the stray fields, use of ring dots for the memory cells is proposed because the ring dots do not cause the stray fields. In the ring dots, clockwise and counterclockwise magnetizations correspond to the digital information. Therefore, it is necessary to control the circular magnetizations of the ring dots by in-plane magnetic fields. For the control of the circular magnetizations of the ring dots by the in-plane field, we have proposed an asymmetric ring shape [1-4]. In this study, we investigate the magnetization processes of Ni-Fe and Ni-Fe/Mn-Ir asymmetric ring dots, and demonstrate that the circular magnetizations of the asymmetric ring dots can be controlled by the in-plane magnetic fields.

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