Switching of molecular magnets

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Single-molecule magnets draw attention as potential candidates for applications in hybrid spintronics devices and information processing/storage technology. Consequently, the key question arises how to effectively manipulate the molecule in order to write a bit of information on it. One possibility of switching the molecule's moment is external magnetic field. The other one is due to the macroscopic quantum tunnelling phenomenon. However, the current-induced switching seems to be most promising for future applications.

There are, however, several challenging aspects of the current-induced manipulation of the molecule's spin. First, one can hardly control the relative orientation of the molecule's easy axis and leads' magnetizations. Second, intrinsic spin-relaxation time of the molecule significantly influences the switching parameters and also is hardly controllable.

When the energy of the lowest unoccupied orbital (LUMO) level of the molecule is sufficiently low, electronic transport takes place owing to tunneling between the electrodes and the LUMO level. The molecule's switching then occurs when the LUMO level is exchange coupled to the molecule's spin. When the energy of the LUMO level is large enough, electron tunneling to the molecule is energetically forbidden at bias voltages of interest. However, current still can flow due to higher order processes, e.g. cotunneling ones, and switching of the molecule's spin is still possible.

9.7 cm

13.4 cm

Subject category :

4. Spin Electronics and Magneto-Transport

Presentation mode :
oral (invited)

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