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Active control of magnetoresistance of organic spin valves using ferroelectricity

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Organic spintronic devices have been appealing because of the long spin lifetime of the charge carriers in the organic materials and their low cost, flexibility and chemical diversity. In previous studies, the control of resistance of organic spin valves is generally achieved by the alignment of the magnetization directions of the two ferromagnetic electrodes, generating magnetoresistance. Here we employ a new knob to tune the resistance of organic spin valves by adding a thin ferroelectric interfacial layer between the ferromagnetic electrode and the organic spacer: the magnetoresistance of the spin valve depends strongly on the history of the bias voltage, which is correlated with the polarization of the ferroelectric layer; the magnetoresistance even changes sign when the electric polarization of the ferroelectric layer is reversed. These findings enable active control of resistance using both electric and magnetic fields, opening up possibility for multi-state organic spin valves.