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A New Avenue towards Colossal Magnetoresistance in Organic Tunneling Junctions

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A major challenge for the field of organic spintronics is how to achieve large magnetoresistance (MR) in a reliable manner. We have developed a new approach that dramatically improves MR of organic spin valves. Our approach involves using buffer layer assisted growth to prepare magnetic nanodot layers on top of the organic spacer layer. Interdiffusion between magnetic electrode and organic spacer layer has been largely suppressed in devices prepared by this method. Consequently, devices become highly reliable and large magnetoresistance up to a few hundred percent has been obtained. Moreover, we have attempted to insert a single magnetic nanodot layer inside the organic spacer layer. In such a tunneling junction device, even when the electrodes are nonmagnetic, a colossal MR up to 100000% has been achieved at relatively high temperatures. The underlying mechanism has been discussed based on temperature-dependent I-V curves and resistivity measurements.