Magnetic tunneljunctions made from half-metals

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Half-metallic ferromagnets are ferromagnetic materials showing, in the ideal case, 100% spin polarization at the Fermi level E_F, due to a metallic density of states in one spin direction (usually majority spin) combined with a band gap in the other spin direction (usually minority spin). In principle, half-metallic ferromagnets are ideal spin injectors and detectors, because under moderate voltage they can carry current in only one spin direction. Therefore, they also constitute ideal components for tunneling magnetoresistant (TMR) devices, with two half-metallic leads sandwiching a nonmagnetic semiconducting or insulating spacer. On the other hand, the tunneling current in these TMR devices is very small so that the conventional interpretation in terms of a Landauer-Büttiker picture of ideal interfaces are bound to fail. In this talk we emphasize that interface states at the interfaces of tunneljunctions can have severe implications on the tunnel-magnetoresistance ratio. We propose an antiferromagnetically coupled TMR element made of half-metals without interface state based on an *a priori* understanding of the exchange interactions in such systems, as a paradigm of materials design from first principles.

9.7 cm

13.4 cm

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