SEMICONDUCTOR EuS-PbS FERROMAGNETIC MULTILAYERS

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EuS-PbS multilayers constitute all-semiconductor ferromagnetic-nonmagnetic structures with magnetic layers of EuS (a model nonmetallic ferromagnet) and diamagnetic layers of PbS (the well known semiconductor compound with its energy gap in the infrared). As lattice parameters of EuS and PbS match very well the variety of epitaxial heterostructures can be grown by high vacuum deposition techniques. Ferromagnetic transition in EuS-PbS multilayers is observed even in the structures with ultrathin EuS layers of only 0.6 nm (2 monolayers). The Curie temperature depends on the thickness of the magnetic layer as well as on the strain generated because of the difference between the thermal expansion coefficients of the multilayer and the substrate. These effects will be discussed for the variety of EuS-PbS structures grown on various substrates: KCl (100), BaF_2(111) and PbS (100). For sufficiently thin (typically below 3 nm) nonmagnetic PbS spacer layers in EuS-PbS multilayers one observes pronounced magnetic effects related to the antiferromagnetic interlayer coupling between EuS layers. The experimental work as well as the physical mechanisms relevant for this effect will be discussed. Due to the large exchange splitting of the conduction band states in EuS the EuS-PbS multilayers form an intriguing spintronic system. Recent work concerning the tunneling structures exploiting spin filter effect will be reviewed as well.