Abstract

The fully-epitaxial Fe/Si/Fe-system features two properties which are not found in any other trilayer system. First, the silicon-layer acts as a tunneling barrier and second, the two iron electrodes are strongly coupled antiferromagnetically if the silicon layer thickness is about 1-2 nm. There is a legitimate reason to assume that the magnetic coupling in this system can be influenced by an applied voltage, because the coupling is driven by the states at the Fermi-level.
The task given was to observe a change in the coupling strength by magneto resistive measurements (MR) in current perpendicular plane geometry (CPP). Because the Fe/Si/Fe-system does not show any MR-effect, an additional Fe/MgO/Fe-system, showing large TMR-values, is evaporated on top, such that both systems share one Fe-layer.
The samples are prepared by molecular beam epitaxy (MBE). For electrical measurements in CPP-geometry, micron-size lateral structures, which can be accessed from the bottom and the top, have to be fabricated. These structures are made by optical lithography and a combination of sputter deposition and ion beam etching techniques.
Sample series consisting of Fe/Si/Fe-, Fe/Cr/Fe/MgO/Fe- and Fe/Si/Fe/MgO/Fe-layers have been prepared, structured and their transport properties have been measured. Finally, the Fe/Si/Fe/MgO/Fe-system has been taken for measurements concerning the influence of an applied voltage on the magnetic coupling.