UHV-Bonding: Electrical Characterization of Interfaces and Application to Magnetoelectronics

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An artificial grain boundary with covalent bonds is produced by room temperature UHV bonding. The electrical properties of Si-Si interfaces prepared by UHV bonding are compared to hydrophobic pre-bonded interfaces. The interface density of states is of the order 10^{11} cm^{-3} both for pre- and UHV-bonded Si wafers. N- and P-type wafers are compared. Similar experiments are done with GaAs. GaAs interfaces are produced by bonding in Hydrogen at approx. 900 K and by UHV bonding.

The electrical injection of spin polarized electrons into a semiconductor is required for magnetoelectronics. One usual approach is to try to grow an epitaxial film of a ferromagnetic metal directly onto the semiconductor. The growth of a metal film on a semiconductor surface can be described as a solid-gas chemical reaction. We compare the metal to semiconductor interfaces produced by room temperature deposition of metal films to interfaces obtained by UHV bonding of thin metal films to a semiconductor surface. During the UHV bonding a solid-solid chemical reaction is expected.

A spin valve transistor is a metal base transistor with a multilayer of ferromagnetic and non-magnetic metals in the base. The metal multilayer is grown on one Si wafer and bonded in UHV to a second Si wafer. The electrical current from emitter to collector depends on the magnetization of the base layer.