SYFS 1 Overview, phase change and nanocrystal memories

Zeit: Samstag 14:00–14:45 Raum: TU HE101

Hauptvortrag SYFS 1.1 Sa 14:00 TU HE101

Physical aspects and technical prospects of nonvolatile memories — •Heinrich Kurz — Institute of Semiconductor Electronics, RWTH Aachen University, Germany

Retaining data for years when unpowered is crucial for the most handheld electronic communication systems. Today non-volatile memories are dominated by flash concepts with various derivatives. Flash memories will face severe technological problems approaching the 65 nanometer technology node. Among the alternatives PC-RAM appears particularly attractive from physical point of view. Principally the performance of non-volatile memory should improve when the cell size is scaled down beyond the 65 nanometer node. In this talk the physical aspects and technical prospects of the PC-RAM technology will be discussed. In addition self-organization phenomena, recently explored for fabrication of highly dense nanostructures, are shown to open the way to extensions of current technologies towards extremely high storage densities. Examples in the field of quantum dot flash-memories and magnetic mass storage systems will be given.

SYFS 1.2 Sa 14:30 TU HE101

Fabrication of Si nanocrystals for memory application by ion irradiation through SiO_2/Si-interfaces — •B. Schmidt[1], K.-H. Heinig[1], L. Röntzsch[1], A. Mücklich[1], K.-H. Stegemann[2], E. Votintseva[2], and M. Klimenkov[3] — [1]Research Center Rossendorf, Dresden — [2]ZMD AG, Dresden — [3]Research Center Jülich, Jülich

This contribution addresses self-assembling of Si-nanocrystals (NCs) in gate oxides, with special emphasis on size and position tailoring and their application as discrete charge storage centers in nanocrystal memories. The Si NCs for these multi-dot floating-gate memories have been produced by ion irradiation through SiO_2/Si-interfaces. Si excess within SiO_2 is formed by ion beam mixing of Si from the Si substrate and from the poly-Si capping layer into the gate oxide. Ion irradiation with $3x10^{15} - 1x10^{16}$ Si^+ cm^{-2} at 50-100 keV through 50 nm poly-Si and 15 nm SiO_2 on (001)Si results in a considerable Si excess. At the upper and lower interfaces of the gate oxide, this ion irradiation forms a metastable SiO_x composition. Si NCs are formed by phase separation into Si and SiO_2 during post-irradiation thermal treatment. Adjacent to the recovering interfaces, narrow SiO_2 zones becomes denuded of excess Si. More distant excess Si precipitates as Si NCs in the gate oxide. This approach was applied to nMOSFET-NC-memory fabrication in the standard CMOS line at ZMD. MOSFET characteristics in terms of write/erase voltage, duration of the programming time, endurance and retention have been evaluated.