thermally activated flux flow for the low parts of the superconducting transition are responsible for the resistivity of MgB_2 near the superconducting transition. The reasons for the observed extraordinary strong dependence of the activation energy of flux motion on the external magnetic field are discussed

TT 34.5 Fri 11:15 H19

Pinning and disorder effects of SiC and C additions in MgB_2 by magnetic relaxation and specific heat analysis — •C Senatore[1], R Lortz[1], SX Dou[2], and R Flükiger[1] — [1]DPMC and MaNEP, Universite de Geneve, Switzerland — [2]Institute for Superconductivity and Electronic Materials, University of Wollongong, Australia

The relatively high T_c and the reduced fabrication costs of MgB_2 render this material promising for industrial applications, especially in substitution to Nb_3Sn in the magnetic field range 9-12 T or in view of cryogen free devices, operating at 20 K. The addition of nanometric powders of SiC and C enhances both B_{irr} and J_c. However, the underlying physical mechanism is not completely understood. We have analyzed the effects of SiC and C doping on the superconducting properties of MgB_2 bulks by means of specific heat and magnetic relaxation measurements. Pinning in MgB_2 is governed by grain boundaries. To discriminate the influence of the additions on the pinning properties from the grain size effects, magnetic relaxation measurements have been performed on doped samples sintered at different temperatures. A series of binary MgB_2 has been used as reference. Doping introduces disorder into the superconductor and thus raises B_{c2}. In the case of $MgB_{1.9}C_{0.1}$, specific heat measurements show that the C substitution on the B sites modifies the low temperature shoulder related to the second gap. This effect is not visible in the samples doped with SiC. SiC leads to an inhomogeneous distribution of C as seen from the distribution of T_c determined from the calorimetric data.

TT 34.6 Fri 11:30 H19

MgB_2 - a self organised critical system — •Andreas Heinrich[1], Emmeram Stark[1], Monika Panhans[1], Bernd Stritzker[1], and Rudolf Schneider[2] — [1]Universität Augsburg, EPIV, 86135 Augsburg — [2]Forschungszentrum Karlsruhe, IFP, Karlsruhe

Systems like a sand hill or water droplets are treated in terms of a self organised critical system. Thereby several conditions apply for such a system: it should consist of many components, it should organise itself into a critical state, there should be an exceptional event - like an avalanche, this events should be invariant in time and scale, etc. Here we would like to present magneto optical investigations of flux penetration into MgB_2 thin films. Thereby one can differ between a homogeneous and an avalanche like flux penetration. We will show that especially the avalanche like flux penetration can be treated like a self organised critical system. In comparison with a sand hill we will demonstrate the avalanche or dendrite flux formation in MgB_2 exhibit all requirements mentioned above.

15 min. break

TT 34.7 Fri 12:00 H19

Vortex lattice in superconducting films of finite thickness — •Ernst Helmut Brandt — Max-Planck-Institut für Metallforschung, Stuttgart

Magnetic stray field, currents, self-energy, and interaction of vortices in superconductor films of any thickness are of interest for numerous applications. In the London limit of negligibly small vortex core, the general analytical solution for arbitrary arrangements of straight and curved vortex lines is given in [1]. For finite vortex core size, the corresponding solution of Ginzburg-Landau theory is needed, which requires huge numerical effort. However, if the vortex lattice is ideally periodic in the film plane, the problem simplifies and an extension of a previous bulk method is possible, which includes the stray field energy outside the film. This calculation was performed for vortices oriented perpendicular to the film [2]. A similar computation is possible also for a periodic arrangement of arbitrarily tilted or curved vortex lines in a thick film.

[1] G. Carneiro and E. H. Brandt, Phys. Rev. B **61**, 6370 (2000).
[2] E. H. Brandt, Phys. Rev. B **71**, 014521, 1-12 (2005).

TT 34.8 Fri 12:15 H19

Vortex induced deformation of the superconductor crystal lattice — Pavel Lipavsky[1], •Klaus Morawetz[2,3], Jan Kolacek[4], and Ernst Helmut Brandt[5] — [1]Faculty of Mathematics and Physics, Charles University, Ke Karlovu 3, 12116 Prague 2, Czech Republic — [2]Institute of Physics, Chemnitz University of Technology, 09107 Chemnitz, Germany — [3]Max Planck Institute for the Physics of Complex Systems, Noethnitzer Str. 38, 01187 Dresden, Germany — [4]Institute of Physics, Academy of Sciences, Cukrovarnická 10, 16253 Prague 6, Czech Republic — [5]Max Planck Institute for Metals Research, D-70506 Stuttgart, Germany

The deformation of the superconductor crystal lattice caused by Abrikosov vortices is expressed as response of the elastic crystal lattice to electrostatic forces. It is shown that the lattice compression is linearly proportional to the electrostatic potential known as the Bernoulli potential, which is related to the kinetic energy of the supercurrents. Possible consequences of the crystal lattice deformation on the effective vortex mass are discussed. [cond-mat/0609669]

TT 34.9 Fri 12:30 H19

Structurally induced anisotropic formation of vortex avalanches — •J. Albrecht[1], H.-U. Habermeier[2], A. Matveev[3], D.V. Shantsev[4], Y.M. Galperin[4], and T.H. Johansen[4] — [1]MPI für Metallforschung, Heisenbergstr. 3, D-70569 Stuttgart, Germany — [2]MPI für Festkörperforschung, Heisenbergstr. 1, D-70569 Stuttgart, Germany — [3]Chemistry Department, Lomonosov MSU, 119992 Moscow, Russia — [4]Department of Physics, University of Oslo, Blindern, 0316 Oslo, Norway

Anisotropic penetration of magnetic flux in MgB2 films grown on vicinal sapphire substrates is investigated using magneto-optical imaging. Regular penetration above 10 K proceeds more easily along the substrate surface steps, anisotropy of the critical current being 6 %. At lower temperatures the penetration occurs via abrupt dendritic avalanches that preferentially propagate perpendicular to the surface steps. This inverse anisotropy in the penetration pattern becomes dramatic very close to 10 K where all flux avalanches propagate in the strongest-pinning direction. The observed behavior is fully explained using a thermomagnetic model of the dendritic instability.

TT 34.10 Fri 12:45 H19

Critical currents in high-temperature superconductor/ferromagnet heterostructures — •Märit Djupmyr[1], Soltan Soltan[2,3], Hanns-Ulrich Habermeier[2], and Joachim Albrecht[1] — [1]Max-Planck-Institut für Metallforschung, Heisenbergstr. 3, D-70569 Stuttgart — [2]Max-Planck-Institut für Festkörperforschung, Heisenbergstr. 1, D-70569 Stuttgart — [3]Physics Department, Faculty of Science, Helwan University, 11795 Cairo, Egypt

The critical current in bilayer structures consisting of high-temperature superconducting $YBa_2Cu_3O_{7-\delta}$(YBCO) and ferromagnetic $La_{2/3}Ca_{1/3}MnO_3$ thin films, is substantially influenced by the presence of the ferromagnetic layer at low temperatures. Using quantitative magneto-optics a detailed analysis of the temperature dependence of the critical currents is done in the range T=10-90 K, giving information about the mechanisms of flux line pinning. For YBCO thin films, different current limiting mechanisms have been found depending on temperature and microstructure. For temperatures above T=40 K thermal depinning of flux lines is most important for the YBCO thin films as for the bilayers. Below T=40 K, the granularity of the film plays an important role for the current transport in the YBCO thin film and the ferromagnetic layer strongly affects the critical current in the bilayer.