Nanocomposites and nanomaterials

Combined vortex lattice of Mo/Si multilayer nanostructures in tilted magnetic field

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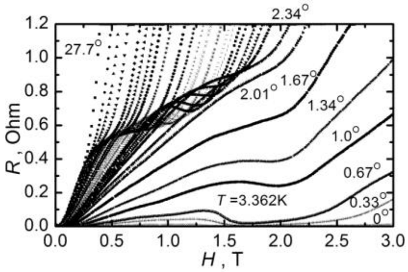
The commensurability effects were discovered on nanoscaled superconductor-insulator Mo/Si multilayers (ML), which occur in parallel to the layers and slightly inclined magnetic fields [1]. At some temperature corresponding to the fitting of the vortex cores within semiconducting interlayers a minimum (or minima) appears on the dependences of the resistivity *R* on magnetic field *H*. While temperature decreases the minimum becomes more pronounced and then transforms into a large zero resistance region. This effect can be explained in terms of the intrinsic pinning and the vortex lattice commensurability with the period of multilayers. The experimental data are in agreement with the Ivlev, Kopnin, Pokrovsky theory in the case of a strong intrinsic pinning. The lock-in transition is observed on Mo/Si ML [1] in the weakly tilted magnetic fields. Due to the anisotropy, at relatively small angles the confinement of the vortices parallel to the layers becomes more energetically favorable than the creation of tilted vortices. These results are consistent with the theoretical predictions of Feinberg and Villard. Here we present new experimental investigations of the resistive transitions of the Mo/Si multilayers in a wide angle range. For Mo/Si samples it is found that at some larger angles than required for the lock-in state no minimum is observed on the *R*(*H*) curves and vortices are tilted. But at much larger angles the pronounced minimum in the dependences *R*(*H*) reappears. The existence of this anomaly in strongly inclined fields can be explained in terms of the combined vortex lattice predicted theoretically in a number of studies.



1. *M.Yu. Mikhailov et al.* // Low Temp. Phys. – 2005. – **31**. – p.244–253.