

ABSTRACT

ABSTRACT

It is known that, the magnetic field penetrates into type II superconductors as lines of Abrikosov vortices.

The aim of this research is to study the behavior of the elliptic closed vortex in bounded type II superconducting shaped as an elliptic cylinder. For homogenous superconductors, the vortices and their interactions with the surface of the sample determine the properties of the sample.

This thesis contains three chapters and two appendices.

In chapter I, a general introduction about superconductivity is present. Chapter II contains the derivation of London equation in elliptic cylinder coordinates and it's solution. Thus the form of the magnetic field of a solitary Abrikosov vortex with an elliptic shape is obtained. From which the free energy, the current density, and Gibbs free energy for the vortex are derived. The vortex may be an expanding or a collapsing vortex according to whether the direction of the vortex magnetic field is opposite or equal in sense to the direction of the magnetic field which is created by the applied current. It is important to mention that, in the limiting case, our results for the elliptic cylinder become exactly that for the circular cylinder case, which was published.

Using a personal computer with a Pentium III processor, the computations of the physical quantities of the sample were carried out as given in chapter III. By taking into account the vortices and the sample are confocal ellipses, the free energy, Gibbs free energy for expanding and collapsing vortex, the energy barrier and its position for expanding and collapsing vortex are calculated and discussed. Also the critical current density for the sample is calculated. These calculations are done for different Ginzburg-Landau (GL) parameters.

A comparison between the theoretical results, for the critical current, and that published experimental data is done for thin films.

Appendix A, is concerned with detailed derivations of London equation and the current density in elliptic coordinates.

Appendix B, is concerned with detailed derivations of the free energy of the system.