## CT13

# Observation of Magnetic Field dependent Two-step Superconducting Transition on Nb/Gd Bilayer

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It has long been accepted that superconductivity and ferromagnetism are two mutually antagonistic phenomena. Recently, there is considerable theoretical and experimental interest in studying artificial ferromagnet (FM) - superconductor (SC) hybrid structures [1].

We prepared several Nb-Gd bilayers by DC magnetron sputtering and measured superconducting Resistance (R) - Temperature (T) transition in different magnetic fields (0-15 kOe) applied parallel to the plane of the film and to the current. A prominent two-step R - T transition is observed in the upto 10 kOe. The two step transition is reminiscent of the domain wall superconductivity in the superconducting layers deposited on Insulating ferromagnetic substrates [2], with the superconducting region right below a domain wall exhibiting a higher transition temperature compared to that below a ferromagnetic domain. Such a conclusion is consistent with (a) the disappearance of the two step behavior with increasing applied field, b) the observed magnetic history dependent R - T transitions, (c) two step Voltage (V) - Current (I) curves at different temperatures across the R - T transition at zero field, (d) magnetic history dependent V - I characteristics (inset of Fig. B).

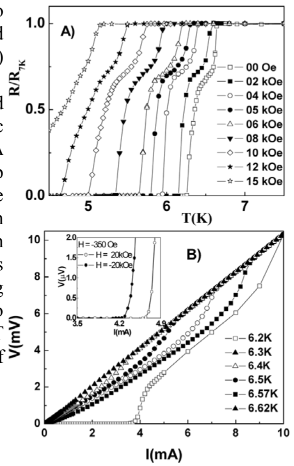


**Fig. 1.** R-T's and V-I's curves and Inset histery depdent $I_C$.

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## CT14

# Effect of Magnetic Field on Transient Natural Convection Heat Transfer

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It is well known that natural convection heat transfer can be damped with the help of a magnetic field. Study and thorough understanding of the momentum and heat transfer in such a process is important for the better control and quality of the manufactured products [1-3].

Natural-convection flow in the presence of a magnetic field in an enclosure heated from left and cooled from right side is considered. In this study fluid is molten sodium which it's thermal and electrical properties such as heat capacity, thermal and electrical conductivity are temperature dependent. In our formulation of governing equations, mass, momentum, energy equations are applied to the enclosure. To solve the governing non-linear differential equations a finite volume code based on PATANKAR's SIMPLER method is utilized. The results are obtained for Rayleigh numbers (Ra) between $10^5$ and $8\times10^6$, Hartmann numbers (Ha) between 0 and 300. The results show that the strength of the magnetic field has significant effects on the flow and temperature fields.

Results present that the average Nusselt number varies with the Raleigh number for several values of Ha. The effect of a magnetic field on the Nusselt number is more in the low Raleigh number region. At a high Raleigh number, the magnetic field reduces the Nusselt number only slightly. This is due to the dominance of convection at high Raleigh number. Also it is shown that the transient response of the central value of the stream functions. The central value of the stream function oscillates in the absence of a magnetic field and this oscillation dampens slowly almost to zero after some time. However the oscillatory flow induced by buoyancy forces is damped completely with the increasing Ha.

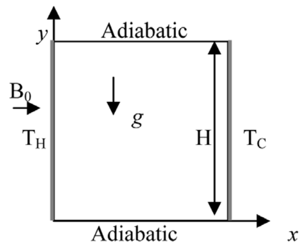


**Fig. 1.** Geometry and coordinates of enclosure configuration with magnetic effect.

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