Seminar Title: Thermal Performance Assessment of Tungsten Based Magneto-Resistive Heat Switch at different oblique plane angle for Space Application

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Abstract:

Cryogenic heat switches are a critical component of many space's cryogenic systems. These heat switches are commonly used to control the flow of heat between two surfaces and are classified into many categories. Among them, magneto-resistive heat switch (MRHS) is used for controlling the heat flow at a very low temperature of below 10 K. Tungsten is material for magneto-resistive heat switch due to its lower critical and high Debye temperature. Tungsten based magneto-resistive heat switch (TMRHS) work on the principle of controlling the heat flow at an applied magnetic field. This makes it suitable for space applications where there is a need for regulating the heat flow at a cryogenic temperature of below 10 K. So, in the present study, the thermal performance of TMRHS at different oblique plane angle in detail by developing an analytical model. Initially, an analytical model is developed using conductivity tensors for predicting the thermal conductivity on three mutual perpendicular planes (X, Y, Z) passing through a point then find expressions for thermal conductivity on different oblique plane. Later, the developed model has been compared with the experimental data available in the literature and observed reasonable agreement with a maximum possible error of ±4.7%. Thereafter, using the developed model, the thermal performance at different oblique plane and at different angles in Tungsten material of the magneto-resistive heat switch is analyzed in detail using temperature, magnetic field, switching ratio as performance parameters. Further, it is realized that the developed model procedure can be adopted for assessing the thermal performance of different heat switches that are used for space applications.