

# Heat Transfer Enhancement From Heated blocks under Laminar Natural convection in a Vertical channel

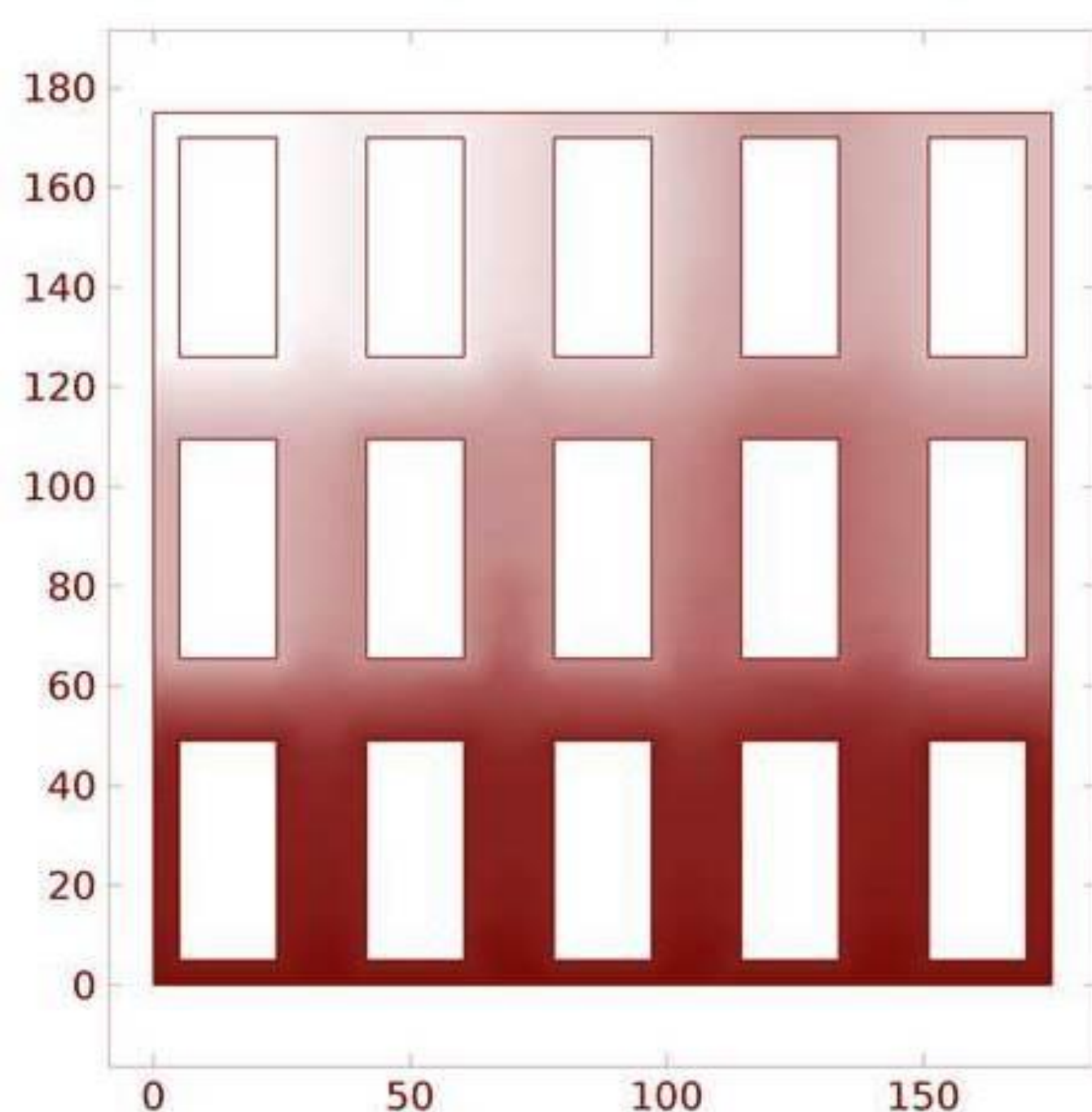
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**INTRODUCTION:** Miniaturization of electronic equipment results in high chip level heat flux density that require high rate of heat transfer from electronic equipment for its safe and reliable operation. Therefore the main objective of this work is to find the optimal configuration of heat sources on the substrates of different thermal conductivity to study the heat transfer characteristics. Fig. 1 shows the design of substrate board and Table 1 show the heat source details.



Heat source	Size, mm
1, 6, 11	42x15x5
2, 7, 12	30x15x5
3, 8, 13	20x15x5
4, 9, 13	15x15x5
5, 10, 15	10x15x5

Figure 1. Substrate board

Table 1. Heat source details

**COMPUTATIONAL METHODS:** Heat Transfer Module of COMSOL Multiphysics® 4.3b is used to study the heat transfer from solids and fluids. Fig. 2 show the physical model.

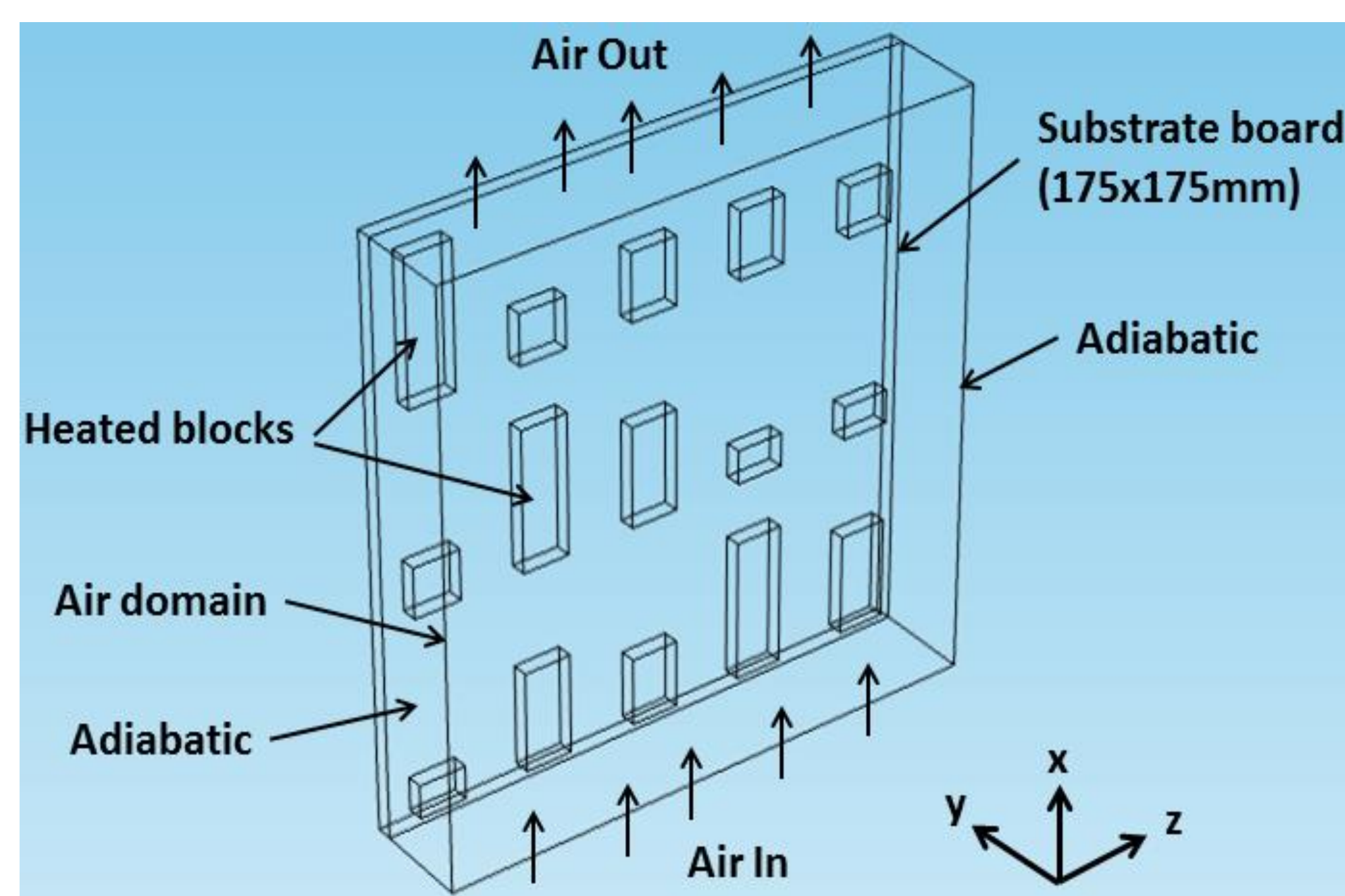


Figure 2. Physical model

**RESULTS:** Single and multilayer copper clad board (CCB) of thermal conductivity  $k = 8.8$  and  $40.5$  W/m K, respectively are used as substrates mounted with fifteen rectangular aluminum heat sources in optimal configuration. Fig. 3 and 4 Show the temperature contour plots for single and multilayer CCB at heat flux value of  $2500$  W/m<sup>2</sup>. The maximum temperature in case of multilayer CCB is  $71.2$  and that in single layer CCB is  $80.7$ deg C, respectively it is because of the different thermal conductivity of substrates. It is found from that for the same heat input the maximum temperature in case of multilayer CCB is lower compared with the single layer CCB.

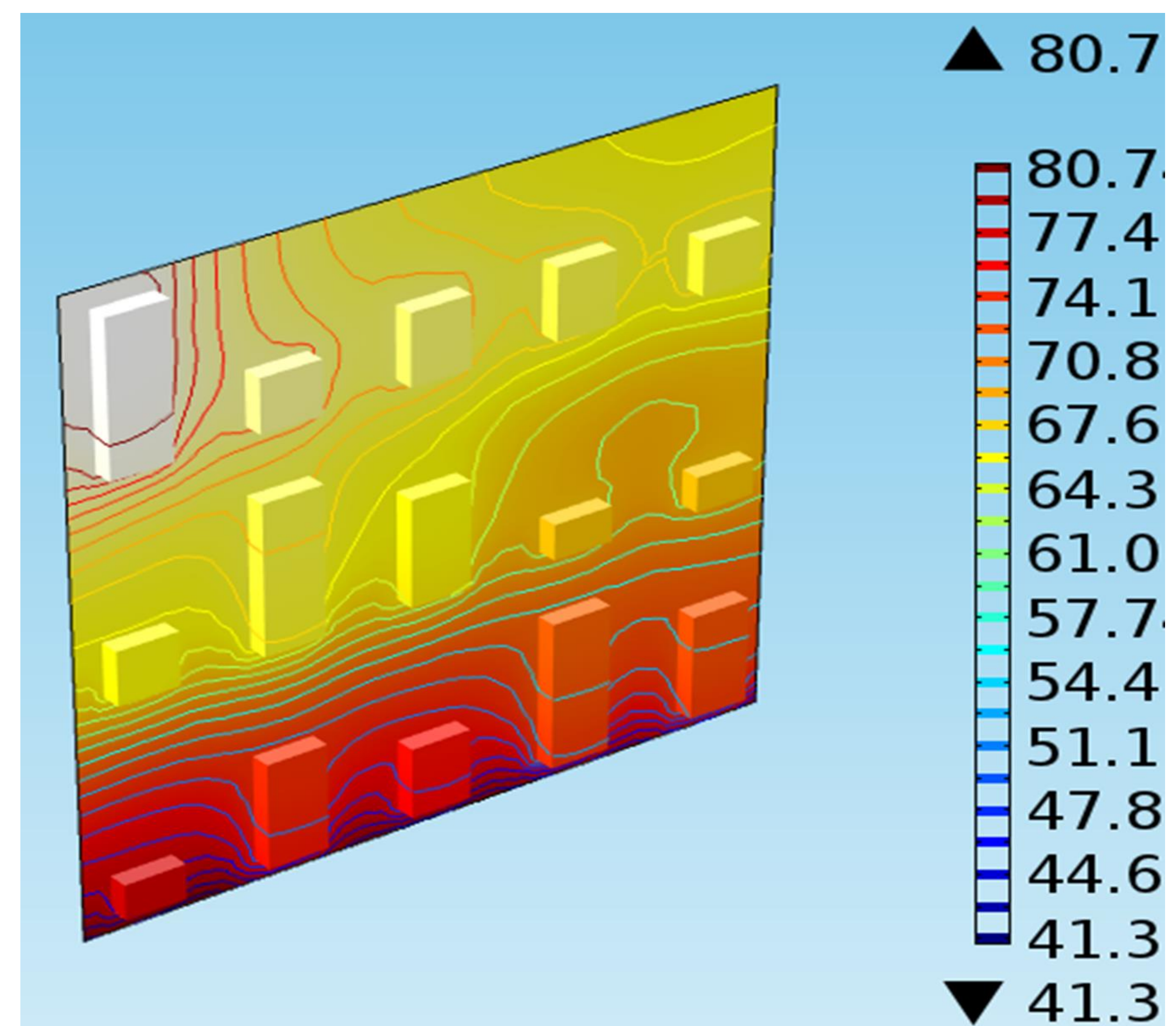


Figure 4. Temperature contours for single layer CCB.

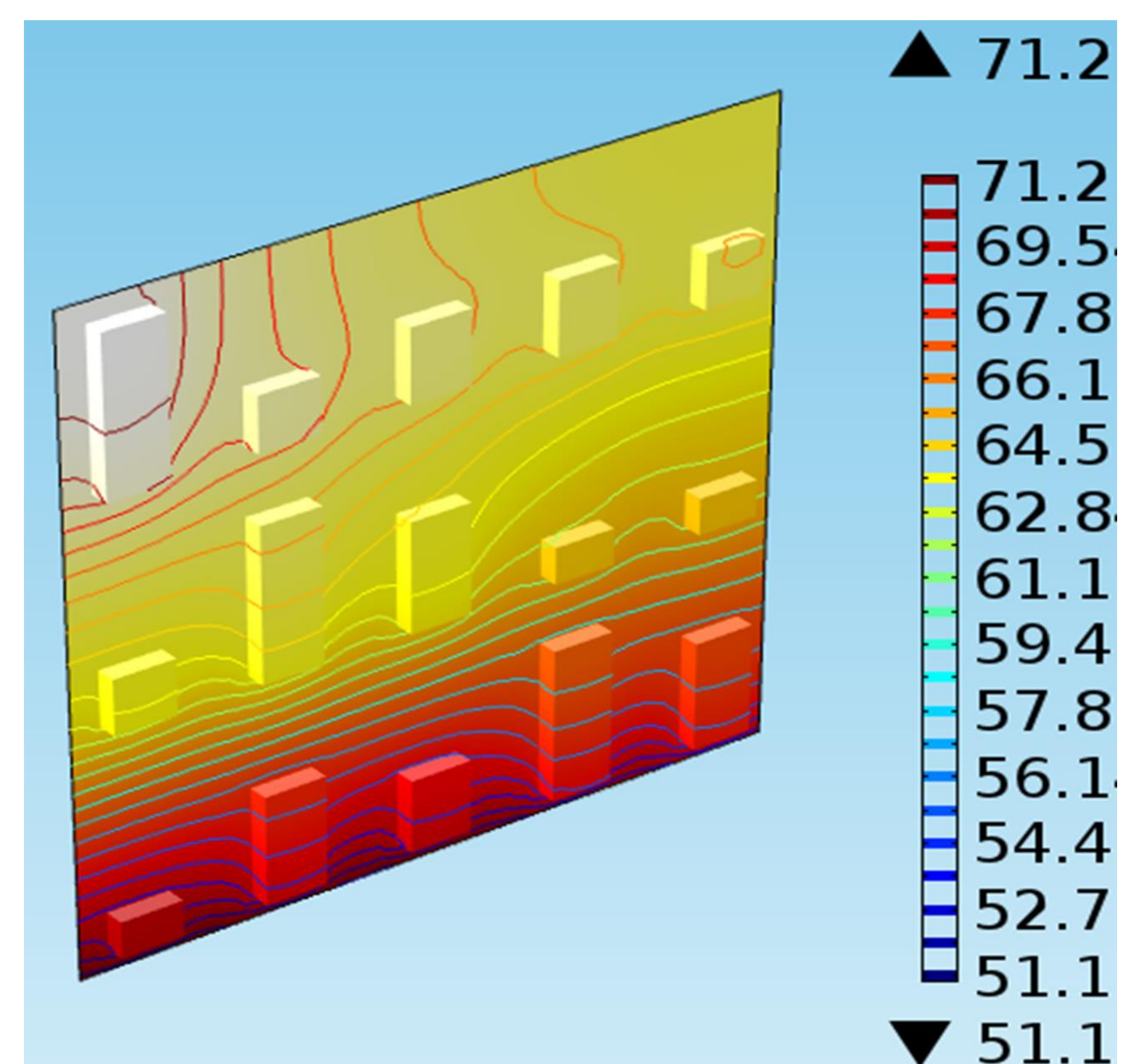


Figure 4. Temperature contours for multi layer CCB.

## CONCLUSIONS:

- Study shows that maximum temperature depends on position and size of heat source.
- Optimal configuration has a minimum temperature.
- The rate of heat transfer from electronic equipment is greatly depends on thermal conductivity of substrate board. Multilayer CCB results in lower temperature.
- This problem is very useful for electronic industry.
- Experiments are performed to validate the simulation results.

## REFERENCES:

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