

Effect of deficient thermal grease on the junction temperature of LEDs package

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Introduction: The use of LEDs package presents thermal problem. In fact, 70% of the power consumption is converted to heat which affects severely the LEDs performance. Air cooling is one of the most useful solution to dissipate heat [1-2]. Nevertheless, it is important to control the contact between the heat sink and thermal grease. In fact, a deficient thermal grease, can widely affect the heat transfer rate, and participate in the LED degradation. In this work, our aim is to study the effect of the air layer thickness on the junction temperature rise.

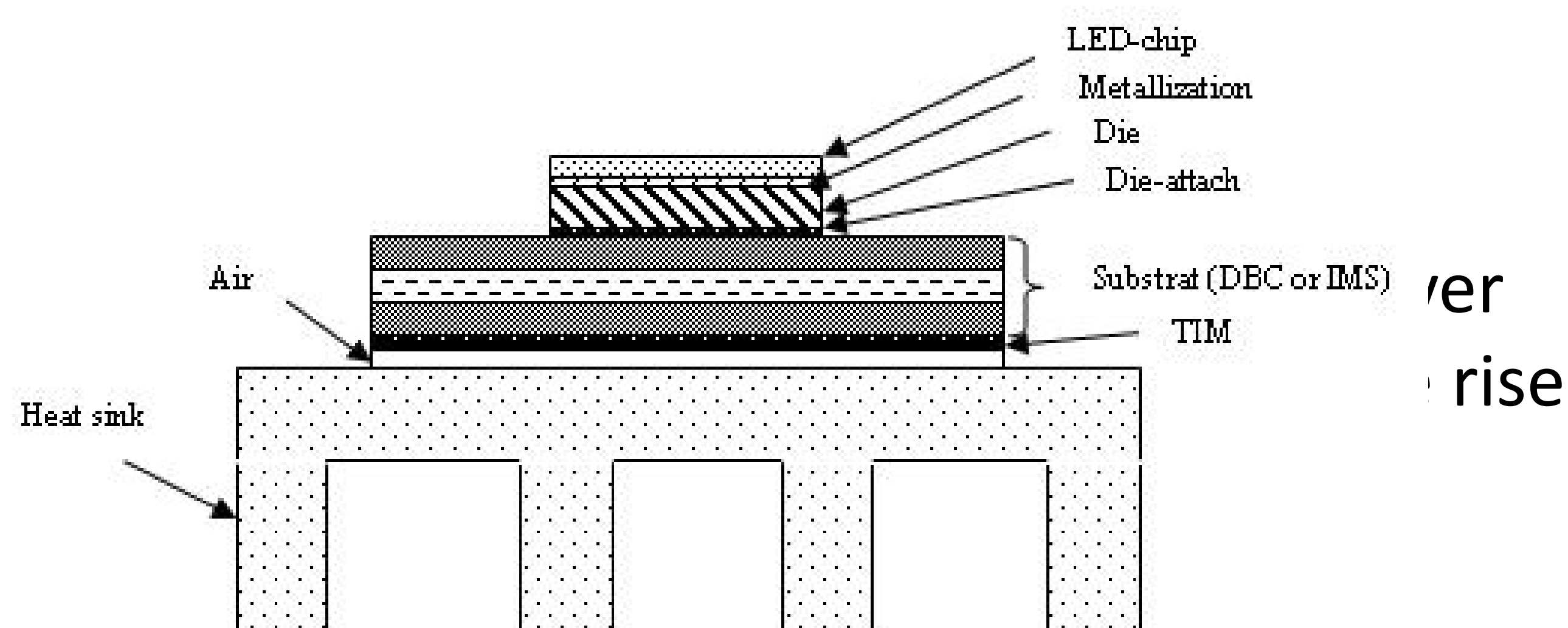


Figure 1. One LED package with deficient TIM

Computational Methods:

✓ Governing equation: $\nabla \cdot (k \nabla T) = 0$

✓ Used module: Heat transfer module

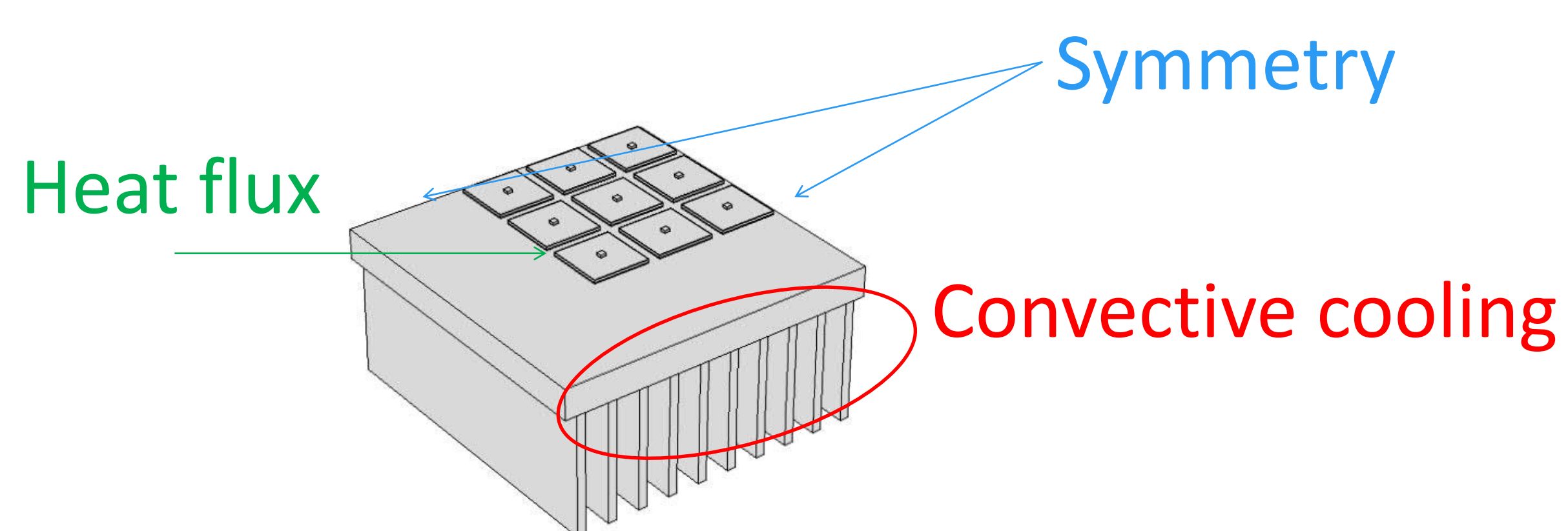


Figure 2. Computational domain and boundary conditions

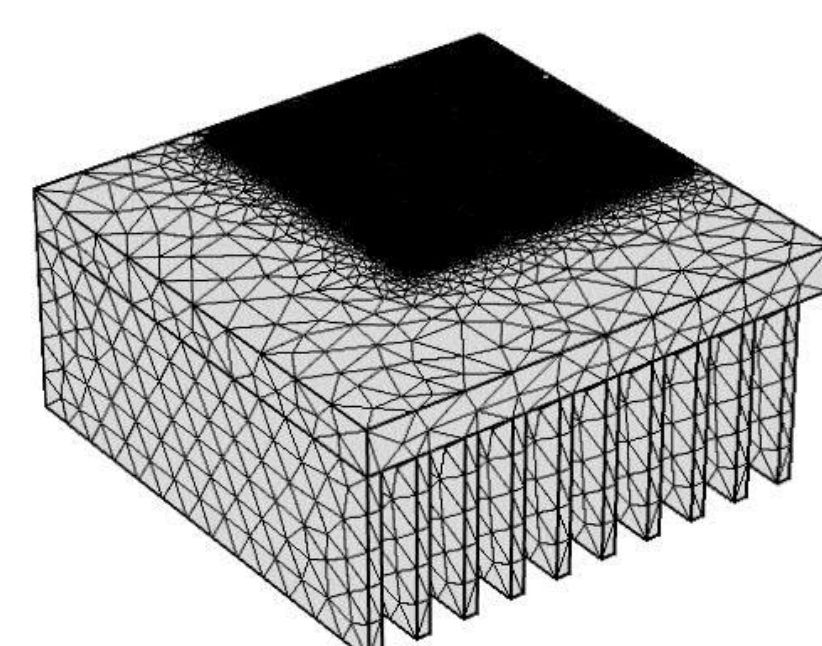


Figure 3. Grid

Results: A higher junction temperature resulted from a thicker air layer. In fact, due to a deficient TIM, air is not transmitted properly to the heat sink.

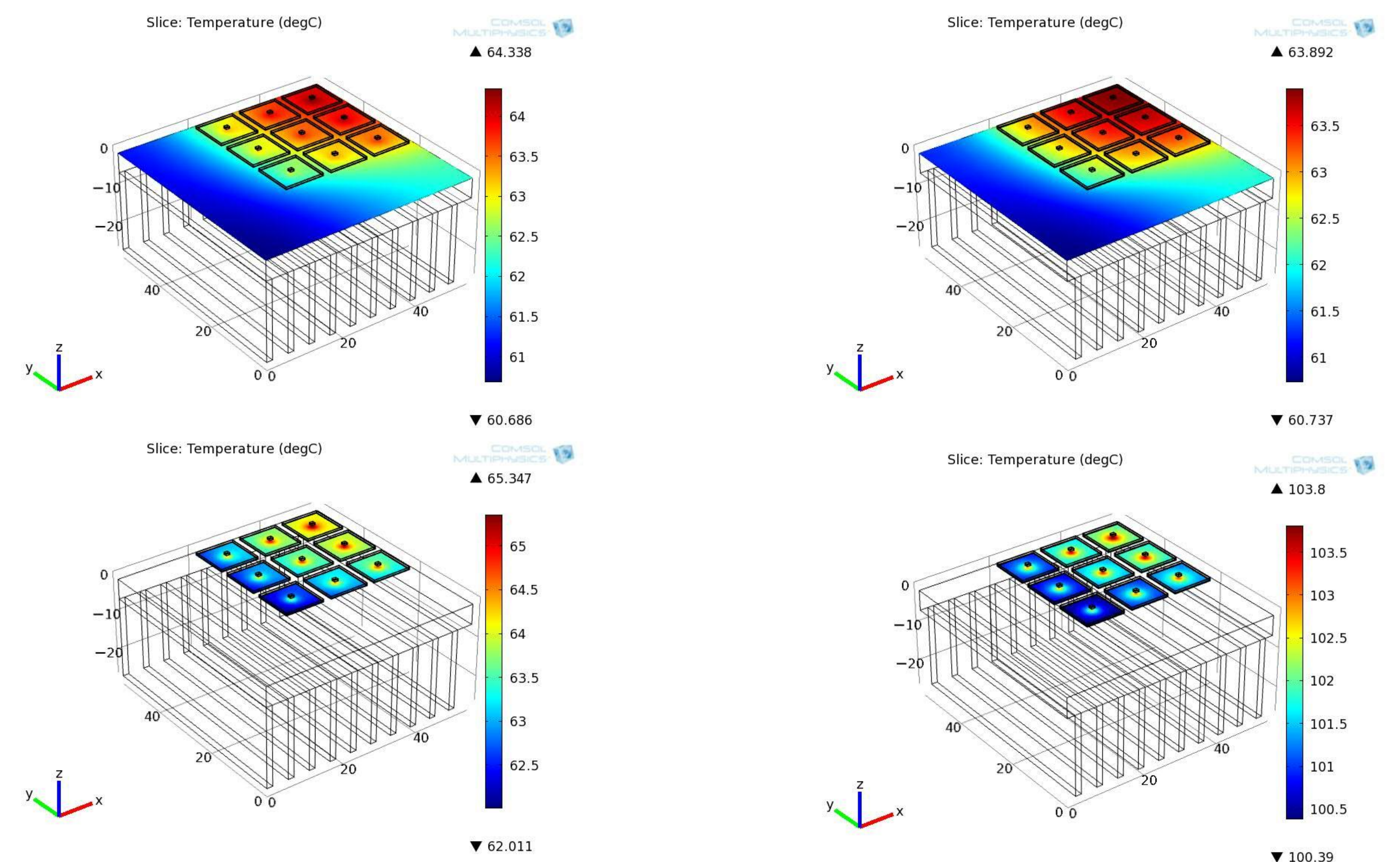


Figure 4. Good TIM VS deficient TIM : Effect on substrate and base temperature

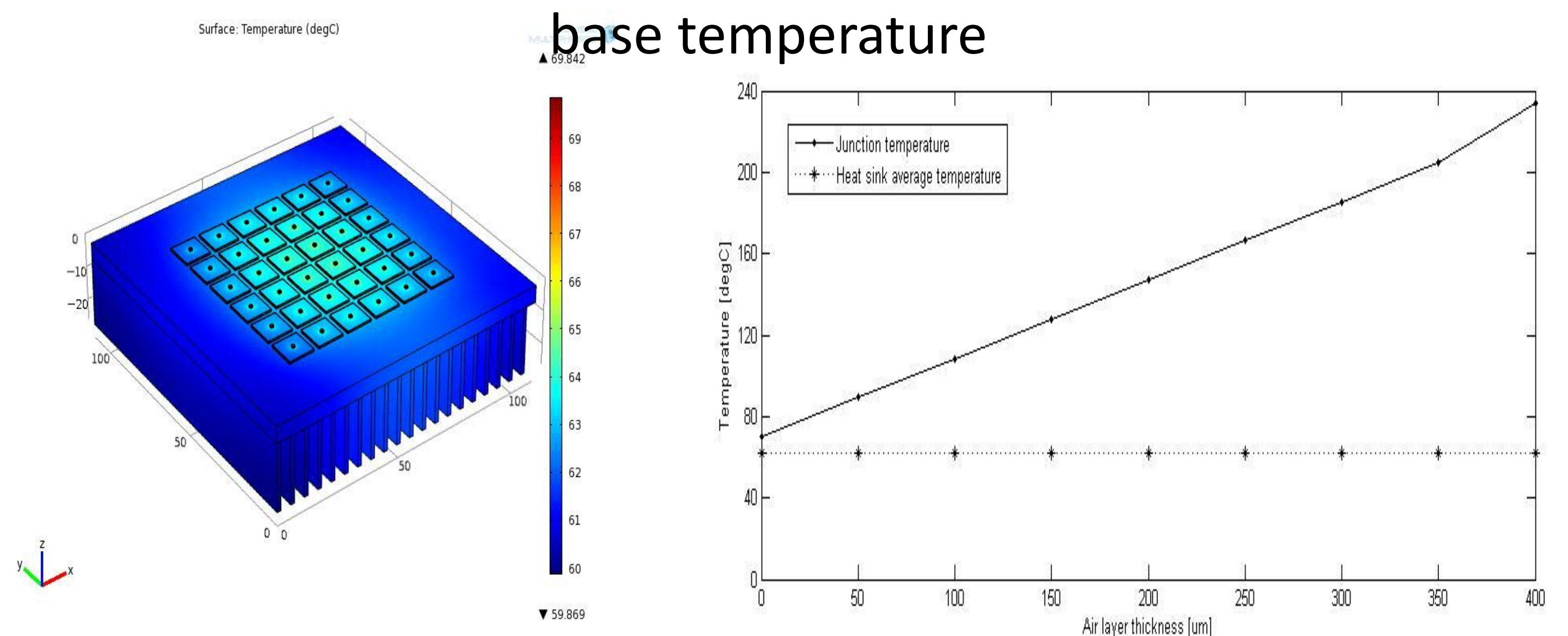


Figure 5. Temperature profile on the LEDs package

Figure 6. Effect of air layer thickness on Temperature rise

Conclusions: An efficient heat sink design is required to enhance the heat transfer rate. But alone, it is not sufficient to solve the thermal problem of LED. This study shows that a bad contact between thermal grease and radiator can decrease severely heat transfer rate.

References:

1. S Yu, Natural convection around a radial heat sink, Int.J. Heat and Mass Transfer, 53, 2935–2938 (2010)
2. S Yu, Optimum design of a radial heat sink under natural convection, Int.J. Heat and Mass Transfer, 54, 2499–2505, (2011)