Assessment of Thermal Resistance on Brass Material of Electronic Packages

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ABSTRACT

Thermal Interface Materials (TIMs) play a key role in the thermal management of microelectronics devices by providing a path of low thermal impedance between heat generating devices. TIMs provide mechanical coupling between the silicon device and the heat spreader sink. During device operation, the adhesive joint between the heat generating device and heat spreader sink is subjected to thermos mechanical stresses due to differences in thermal expansion coefficients of the silicone device and the heat spreader material. The adhesive joint can consequently de laminate the mating surfaces causing a significant increase in thermal impedance across the thermal interface material. TIMs offers improved thermal performance as well as enhanced reliability. In this present work experimentation carried out for different thickness of Brass plates with different loading conditions to determine the thermal resistance.

Keyword - *TIM, Thermal resistances, heat transfer, Thermocouples, surface topography*

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1. INTRODUCTION

The efficiency of heat transfer from heat source to the heat spreader becomes a true challenge which novel electronics technology needs to manage. Generally commercial electronic devices can generate a large amount of heat. Thus, it means that the heat dissipation technology becomes more and more significant to ensure proper operating of electronic devices. The operation of integrated circuits (IC) at elevated temperature is a major cause of failures in electronic devices and a critical problem in developing more advanced electronic packages [1]. According to Moore's law, the number of transistors that can be placed inexpensively on integrated circuits doubles approximately every two years. The thermal management in such systems is therefore an important area of research [2]. The thermal interface materials are commonly one of the best choices to meet the thermal issue requirements. The thermal interface materials basic function is to fill micro-sized surface roughness (i.e. gaps, holes, etc) between two solid materials to improve the conduction of the heat from one material to another by reducing the thermal contact resistance between them. Thermal interface materials include thermal fluids, thermal greases (pastes), resilient thermal conductors, solders (applied in the molten state), and phase change materials (PCMs, which change to the liquid state from the solid state while they are in service) [3]. The major challenge in TIM testing is caused by the fact that there is a significant difference between standardized lab test data and application-specific test results in a given set of application conditions [4-5]. Standardized test methodologies are mandatory for a fair comparison between different TIMs.

2. WORKING METHADOLOGY

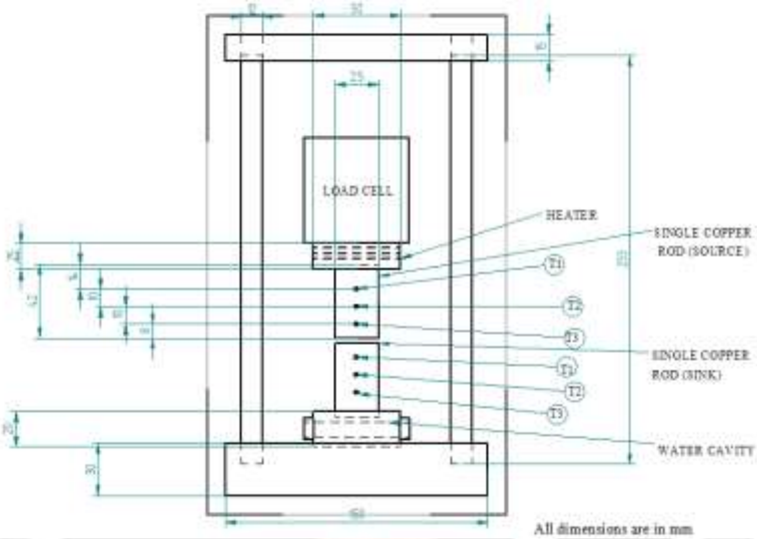

Fig -1: Experiment

The apparatus consists of two copper blocks, which has three thermocouples each. One block has a heater built into it, which acts as the source, while the second copper block has water inlet and outlet, thus acting as sink. The test specimens will be placed in between these copper blocks.The base, supporting pillars and top is made up of mild steel. A rotating handle is provided in order to apply load and a load cell for reading the amount of load applied accurately. An ammeter and voltmeter is used to measure the current and voltage input to the heater. A dimmerstat is employed to control the current input into the heater, thus enabling us to achieve different temperature values. First start the main switch, then by adjusting the dimmer knob give heat input to heater. Take the readings of all thermocouples after attaining the steady state. Make the dimmer knob to 'zero' position and then the main switch off. Repeat the procedure for different heat input.

3. RESULT AND DISCUSSIONS

The discussion is concentrated on to the thermal contact resistance and temperature distribution.
In Chart -1, it is clearly indicates there are some uncertainty of measuring resistance value during the experimentation. Because in this work copper bars are not insulated and also it has not located in a controlled environmental conditions. When compared to these result with a un polished brass material it has noted that resistance values are decreases due to mirror finished surface.

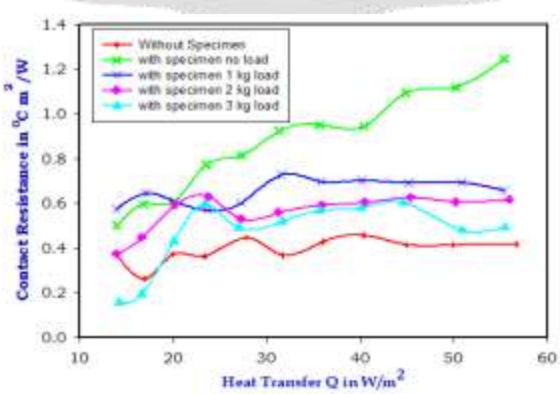

Chart -1: Variation of contact resistance with respect to heat transfer for polished brass material

In Chart -2, it is clearly indicating there are some uncertainty of measuring temperature value during the experimentation. Because in this work copper bars are not insulated and also it has not located in a controlled environmental conditions. When compared to these result with a un polished brass material it has noted that temperature values are increases due to minor air gaps are presents.

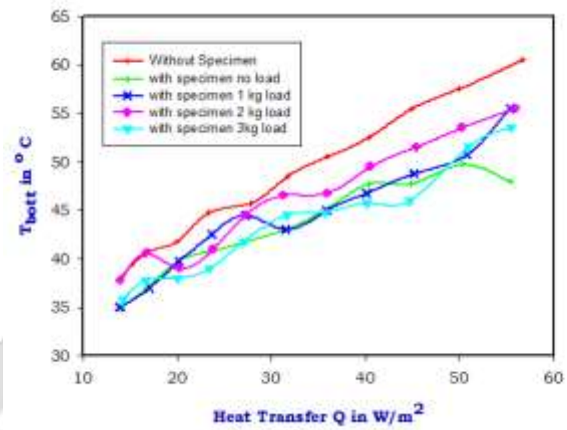

Chart -2: Variation of temperature with respect to heat transfer for polished brass material

In Chart -3, it is clearly indicating there are some uncertainty of measuring resistance value during the experimentation. Because in this work copper bars are not insulated and also it has not located in a controlled environ mental conditions. When compared to these result with a polished brass material it has noted that resistance values are increases due to minor air gaps are presents.

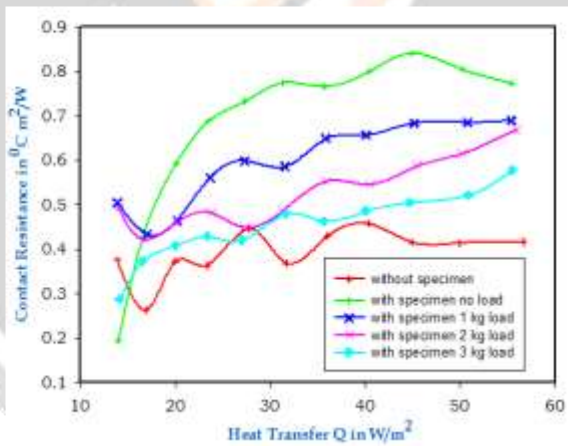

Chart -3: Variation of contact resistance with respect to heat transfer for un polished brass material

In Chart -4, it is clearly indicating there are some uncertainty of measuring temperature value during the experimentation. Because in this work copper bars are not insulated and also it has not located in a controlled environmental conditions. When compared to these result with a polished brass material it has noted that temperature values are increases due to minor air gaps are presents and also there is no perfect contact between the surfaces.

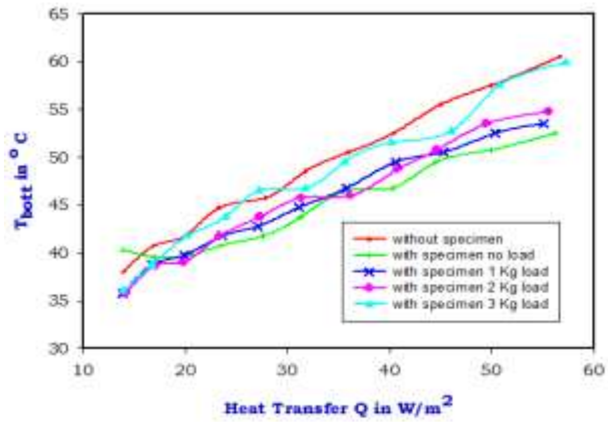

Chart -4: Variation of temperature with respect to heat transfer for un polished brass material

4. CONCLUSIONS

The work is carried out to determine the temperature and the resistance variation of interface material. Brass is selected as an interface material. Tests are conducted for different surface topography, constant and varying load. Surface topography has achieved by emery papers of different mesh size. Experimentation concludes that the thermal contact resistance decreases as the surface is mirror finished and also the temperature variation within the material is less. When the results are compared between polished and unpolished material, with load and without load condition, the resistance and temperature variation is less in polished with load condition.

5. REFERENCES

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