Construction of Thermal Conductivity Measurement Platform Based on 3-Omega Method

Zhou, Rundong (School: Chongqing Bashu Secondary School)

As various electronic devices become miniaturized, their power density skyrocketed, thereby easily resulting in overheating which is potentially detrimental to electronics as it reduces both the reliability and the life span of these components. To provide manufacturers with optimal materials that dissipate heat, thermal conductivity measurement platforms are needed to be built. The 3-Omega Method I took advantage of is an indirect measurement of thermal conductivity that reflects the conductivity of materials through electric signals. Each sample was put underneath a resistor connected to an alternating current source. The alternating current (with a frequency of Omega) would heat the resistor and cause a fluctuation in its resistance. Then, with a designed computer program, voltage (with a frequency of 3-Omega) across the resistor can be measured and plotted against frequency logarithm. After obtained a relationship between the heat conductivity of the sample and the voltage, the heat conductivity can be obtained using derived equations. Compared with other researchers' measurements on the same type of samples, the results lie in the same order of magnitude and a reasonable range. Given the fact that film samples measured couldn't be the same as others', the results acquired were relatively accurate. The experiment showed that the thermal conductivity measurement platform could accurately determine the thermal conductivity of materials. Further researches will be focused on measuring more samples and reducing possible errors.

Awards Won: