Thermal Conductivity of Metallization Via's used in Microelectronic Packages

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In conventional co-fired multilayer alumina microelectronic packaging, the thick film refractory metallization via's used for electrical signal routing also play a role in thermal conduction. This is seen with the common use of a thermal via array. What is less known is the quantitative thermal dissipation improvement due to the metallization structures. Answering this question poses experimental challenges as the co-fired metallization properties cannot be measured independently due to the sintering process interaction with the ceramic body. A quick inspection of the metallization electrical resistivity when compared to elemental tungsten provides insight into this change of physical properties. In the present study, a test coupon containing a high volume fraction of .1 mm diameter via's was measured using the laser flash method. The rear surface transient temperature response curve was then correlated to a unit cell finite element model by varying the metallization thermal conductivity until the low frequency component of the residual error was minimized. Validation of the technique will be discussed using a geometrically (i.e. well controlled) simple periodic metallization/alumina laminate structure used to characterize the in-plane metallization thermal conductivity.