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October 8, 2009 - Updated
October 5, 2009 - Originally Posted

Affects of Silicone Migration

We are researching the affects of silicone migration onto electronic circuitry. We have heard of military contractors not allowing silicone materials in certain parts of the factory. Are you familiar with any potential hazards to health or long-term product reliability due to products exposed to silicone materials?

C. M.

Expert Panel Responses

Silicone conformal coatings have been linked to relay failures due to contamination over time. Silicones also have a tendency to contaminate other surfaces affecting the wetting and surface adhesion of conformal coatings. As coatings move away from solvent based systems due to VOC reduction directives in Europe wetting issues are more obvious. This is due to the fact that VOC free coatings are 100% solids or water based and lack the quasi cleaning ability of traditional solvent based coatings. We would generally not recommend that a conformal coating process is close to any silicone process.

Chris Palin
European Manager
HumiSeal

Chris Palin is currently managing European sales and support for HumiSeal Conformal Coatings. His expertise is in test & reliability, solder technology, power die attach and conformal coating.



The use of silicones for electric and electronics protection is as old as some military application from the late 1940's. Since then the silicones have become one of the most relevant alternatives for electronics protection for reliable applications, and its share continues to growth due the increase demand of current applications and the limits of organic alternatives. The term "Silicone Migration" is also rather old, the first articles talking on the subject date on early 1950's. Why then, if this phenomenon is known and recognized for over half a century the use of silicones is well accepted, recognized and in some cases proven indispensable? The "Silicone Migration" term is one almost every electrical engineer has heard, yet very few actually know its true meaning. Often this term is used to simply restrict or discourage the use of silicones without further explanation and most of the times also unjustified/unnecessarily. One of the reasons is that this term is equally used to describe any of the three contamination mechanism for silicones (which by the way are the same for epoxy, acrylics and urethanes yet then is simply called "contamination"). The three contamination mechanisms are: Transfer by contact (something touching a wet silicone and then touching any other surface), Transfer by atomization (by fine spraying silicone that can be then move airborne and collect in any surface) and Transfer by Low Molecular weight species than can volatilize and condensate at normal operation conditions. The first two account for most of the surface contamination experiences, being the last one the least observed and the most difficult to generate since it requires strictly several conditions to be present to occur. One of the easiest way to prevent the volatile silicone migration is simple to select a Controlled Volatiles product. Since one of the elements that must be present is the SVCC (Silicone Volatile Condensable Compounds) selecting a CV product eliminates the problem. Krayden offers CV products of the Dow Corning product line that include Adhesives, Conformal Coatings, Encapsulants and Thermally Conductive products. These CV products don't have the hefty price tag of space grade materials and are the right answer against this potential "Silicone migration." The Volatile

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Migration is relevant only if all the conditions are present. Not all the volatiles are relevant, only the ones that can condensate at operational conditions. Also it is required to have the electronics in a hermetically confined volume for this to be relevant; if the volatiles can escape their high diffusivity will prevent them to condensate again in relevant amounts. Also an intermittent electrical contact is required for the migration to be relevant like a switch, relay or a motor; an already plugged connector is not an issue if it is not in and out constantly. Finally the volatiles will show it's presence in a certain range of voltage and current intensity. The SVCC are fairly inert and will not dissolve, oxidize or react with any other element on the board. There are means to calculate the amount of volatiles present in an application if all the data is available. Krayden can help via Dow Corning to get this information if required. One important thing to clarify that the risk of the silicone volatile migration has to be estimated on its proper terms, one average a person carry far more silicones volatiles due the use of antiperspirants, hair products, clothes, make up that an average coated PCB! Silicone migration is a far misunderstood and feared topic, yet if you allow us we can help you take the right approach in your material selection for your electronics applications.

Wayne Wagner
President
Krayden Inc.



Wayne Wagner has over 25 years in the conformal coating industry and is the president of Krayden Inc., a leading distributor of engineered materials.

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Circuitnet
6 Liberty Square #2040, Boston MA 02109 USA

Jeff Ferry, Publisher | Ken Cavallaro, Editor/Business Manager

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