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classification determines the time of accelerated equivalent soak by the equivalency of moisture concentration at the critical interface with the standard sensitivity test. This paper proposes a new methodology of accelerated moisture

reflow process. The entire packages are exposed. Thusrecommend
exposure at 60°C/60%RH, which is equivalent to standard MSL-3 preconditioning. Such an accelerated test reduces the total required moisture soak time for MSL-3 by approximately a factor of five. However, such an equivalency (e)-r 92(t)2-32(
which will induce vapor pressure and reduce interfacial adhesion. However, the moisture-induced failure during

where E is elastic modulus, ε_T is the thermal strain, α is the CTE, and ΔT is the temperature change.

Similarly, assuming the package is in the state of zero stress due to hygroscopic swelling when it is fully dry, the hygro-stress is applied on the package due to coefficient of moisture expansion (CME) mismatch at the soak humidity [8-12]. The hygro-stress, σ_H, at the soak humidity can be expressed as

$$\sigma_H = E\cdot\varepsilon_H = E\cdot\beta C \quad (2)$$

where ε_H is the hygro-strain, β is the CME, and C is the moisture concentration.

During the soak, the moisture condenses in the micropores or free volumes of porous materials. The moisture vaporization generates high vapor pressure causing the pore swelling or even braking at the high reflow temperature [13-

The failure rate under standard 216hrs-30°C/60%RH was 4.6%, as shown in Fig. 5. The failure rates under various conditions of 60°C/60%RH are also plotted in Fig. 5 with logarithmic scale. The failure rates under various conditions of 60°C/60%RH can be fitted as Eq. (4)

$$\begin{cases} R = 0 \quad \text{if } t < 57.2 \\ R = 10^{0.05(t-57.2)} \quad \text{if } t > 57.2 \end{cases} \tag{4}$$

where t is the soak time.

By equaling the failure rates under 30°C/60%RH and 60°C/60%RH, the soak time under 60°C/60%RH can be determined as 68.3hrs to be equivalency with the standard 216hrs-30°C/60%RH. The experimental moisture/reflow tests validated the new methodology and the modeling analysis.

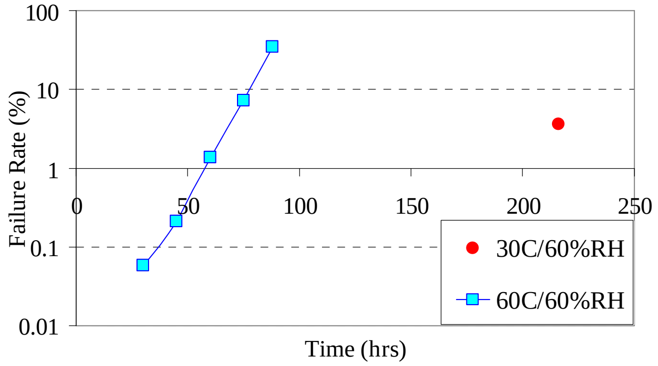

Fig. 5: Failure rate under various conditions

Conclusions

This paper proposes a new methodology of accelerated moisture sensitivity test based on the equivalency of both local moisture concentration and overall moisture distribution for stacked-die MMAP. The new methodology can ensure the same failure rate of cracking/delamination by the equivalency of local vapor pressure, interfacial adhesion as well as the thermal stress and hygro-stress. The novel modeling approaches is applied for moisture diffusion and vapor pressure analysis under the condition of 30°C/60%RH and under the various conditions of 60°C/60%RH. At 70hrs at 60°C/60%RH, both the local moisture concentration at critical interface and overall moisture distribution of package become identical with that at 30°C/60%RH for 216hrs, indicating 70hrs as equivalent soak time compared to the standard MSL-3 preconditioning for this type of MMAP. Such an equivalency of the new accelerated test conditions is proven by moisture/reflow sensitivity experiments under the condition of 30°C/60%RH and12(an)-15(-)]TJ0.d12hnd12(d)-a70(cel)-23(er u)32(l)-16(e)4(d)-2(f)32(aM)16(S0(cerk t)24(o)333(r)-

10.