, S M , IEEE , M , IEEE

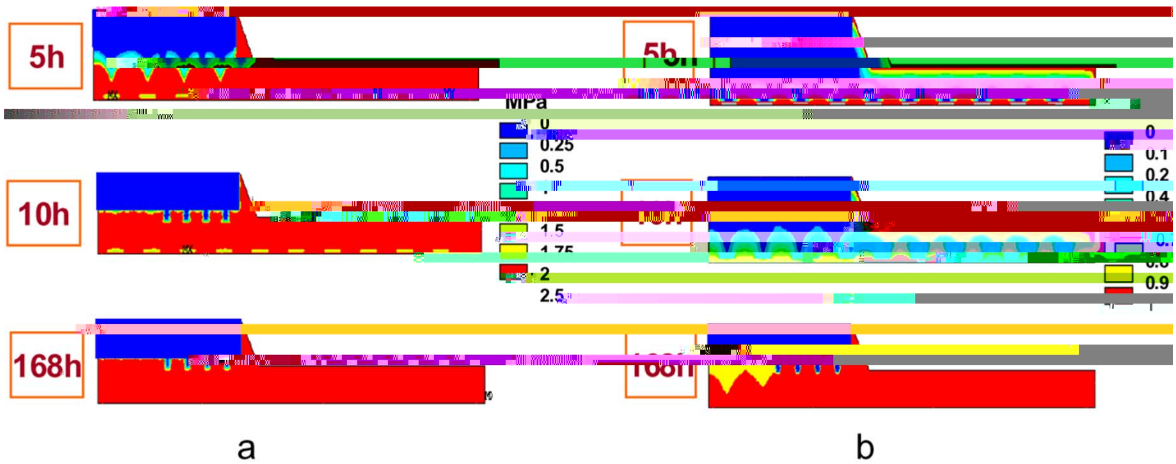
*Abstract*—**This paper first examines the commonly-used thermal-moisture analogy approach in moisture diffusion analysis. We conclude that such an analogy using a normalized concentration approach does not exist in the case of soldering reflow, when the solubility of each diffusing material varies with temperature or the saturated moisture concentration is not a constant over an entire range of reflow temperatures. The whole field vapor pressure distribution of a flip chip BGA package at reflow is obtained based on a multiscale vapor pressure model. Results reveal that moisture diffusion and vapor pressure have different distributions and are not proportional. The vapor pressure in the package saturates much faster than the moisture diffusion during reflow. This implies that the vapor pressure reaches the saturated pressure level in an early stage of moisture absorption, even the package is far from moisture saturated. However, the interfacial adhesion degrades continuously with moisture absorption. Therefore, the package moisture sensitivity performance will largely reply on the adhesion strength at elevated temperature**

$a$ .

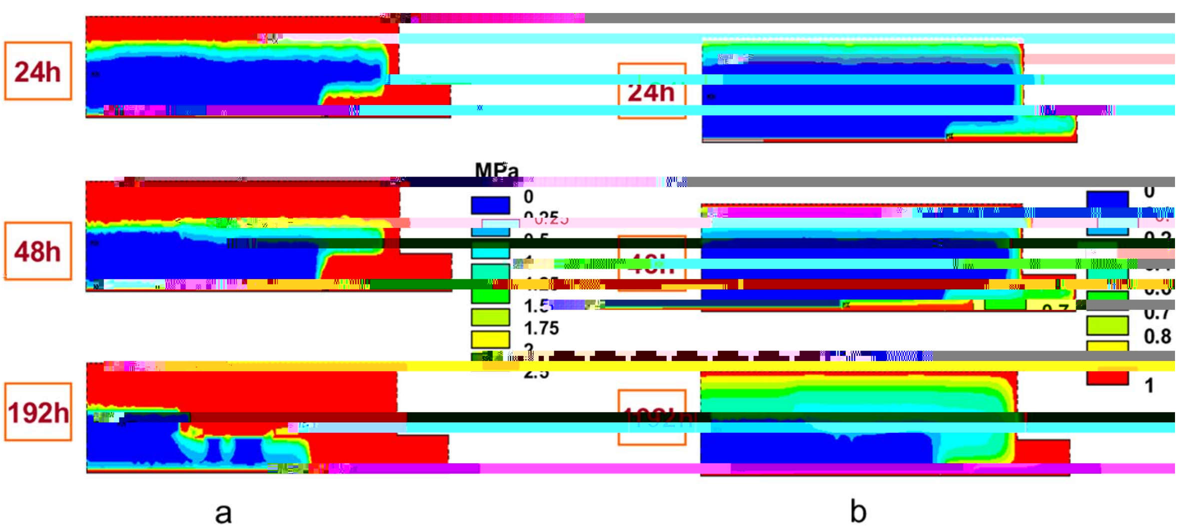
$\circ$

$\cdot \rho_g =$ $\cdot$ $^{-4}$ $^{3}$ $\rho_g$

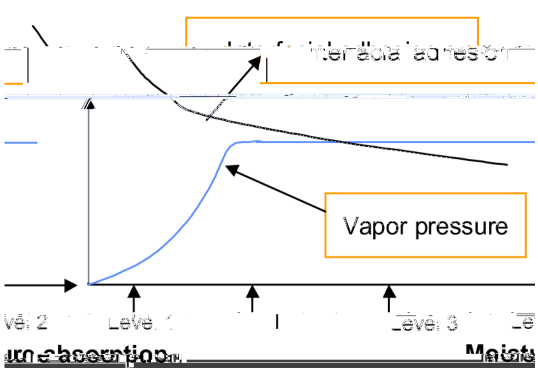
*a* .


5h
10h
168h
MPa
0
0.25
0.5
1.5
2
2.5
0
0.1
0.2
0.4
0.9
a
b

∘

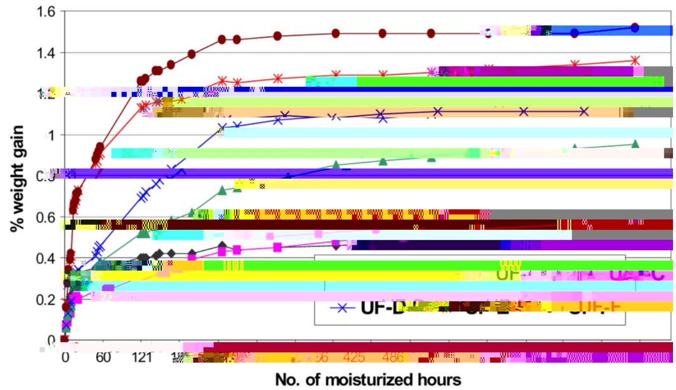

24h
48h
192h
MPa
0
1.5
1.75
0.8
1
a
b

∘

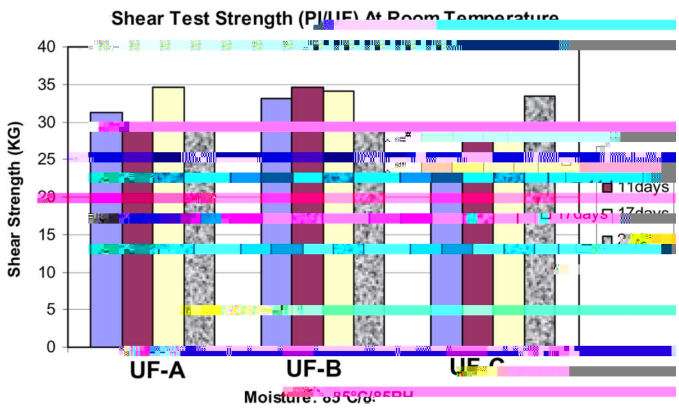

Vapor pressure

∘

*A*




°

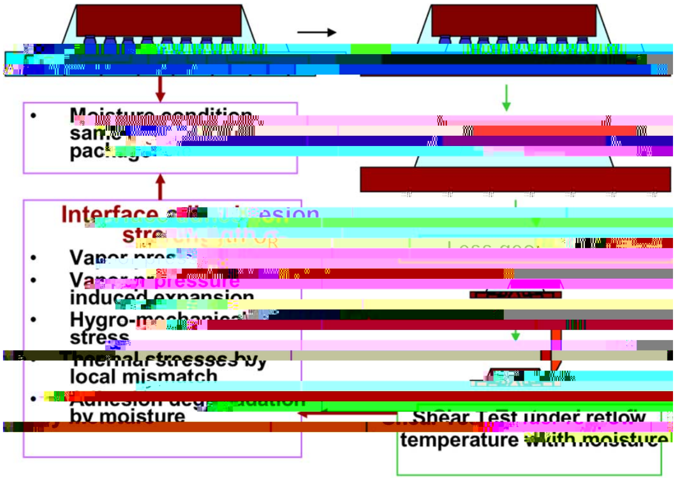


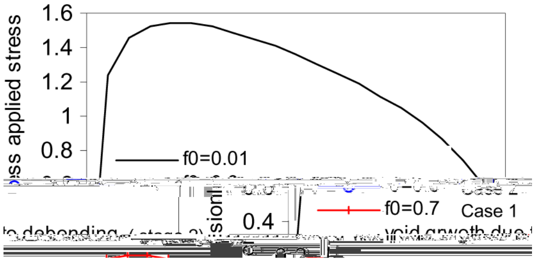

°

| | CTE1 | CTE2 | Tg | E1, E2 |
|---|---|---|---|---|
| UF | [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] |

*A*

*a* .


stress
local mismatch
by moisture
Shear Test under reflow
temperature




$f$

$f =$

$f$

$$\dot{f} = \dot{f}_{\text{growth}} + \dot{f}_{\text{nucleation}}$$
$$\dot{f}_{\text{growth}} = (1-f)\dot{E}_{kk}$$
$$\dot{f}_{\text{nucleation}} = A\dot{\sigma}_e + B\dot{\Sigma}_m.$$

$$\dot{f} = \dot{f}_{\text{growth}}$$

a .

*IEEE T a . C . Pa a . T .*

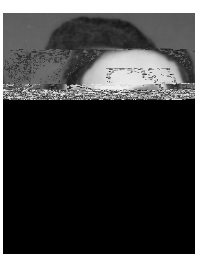
*IEEE T a . C ., Ma a ., Pa a . T .*

*P . E . C .*
*T . C .*

*J. Ma . S .*

*J. E . Ma . T .*

*J. M . P . S*



**Xuejun Fan**