Thermal Stresses in Bonded Joints: W.T. Chen and C.W. Nelson

$Msi := 10^6 psi$ $\Delta T := 100 \Delta °C$ $ppm := 10^{-6}$

Carbon Foam $t_f := 8mm$

$E_f := .25Msi$ $\upsilon_f := .25$ $G_f := \frac{E_f}{2 \cdot (1 + \upsilon_f)}$

$\alpha_f := 4 \frac{ppm}{\Delta °C}$ estimate $G_f = 689.476\,MPa$ *test data 0.15g/cc, G_f ~250MPa*

Aluminum material $t_t := 0.012in$

$E_t := 10Msi$ $\upsilon_t := 0.25$ $G_t := \frac{E_t}{2 \cdot (1 + \upsilon_t)}$ $G_t = 4\,Msi$

$\alpha_t := 12 \frac{ppm}{\Delta °C}$

Epoxy-Like Material $t_a := 0.004in$

$E_a := 400000psi$ $\upsilon_a := 0.35$ $G_a := \frac{E_a}{2 \cdot (1 + \upsilon_a)}$ $G_a = 1.481 \times 10^5 psi$

$$\beta := \left[\sqrt{\frac{G_a}{t_a} \cdot \left(\frac{1}{E_f \cdot t_f} + \frac{1}{E_t \cdot t_t} \right)} \right] \qquad \beta = 1.099 \times 10^3 \frac{1}{m}$$

$$\tau_{max} := \frac{(\alpha_t - \alpha_f) \Delta T \cdot G_a}{\beta \cdot t_a} \qquad \tau_{max} = 1.062 \times 10^3 psi$$

ME 7159 by AI Technology "Stress free epoxy" $\upsilon := 0.45$

$E_{sf} := 17000psi$ $G_{sf} := \frac{E_{sf}}{2 \cdot (1 + \upsilon)}$ $G_{sf} = 5.862 \times 10^3 psi$

$$\tau_{sf} := \frac{(\alpha_t - \alpha_f) \Delta T \cdot G_{sf}}{\beta \cdot t_a} \qquad \tau_{sf} = 42\,psi$$

AIT reworkable epoxy, lap shear=1200psi

ME 7159 Thermal conductivity=11.6W/mK

CGL7018 lap shear <100psi **EG7658 lap shear =1000psi**