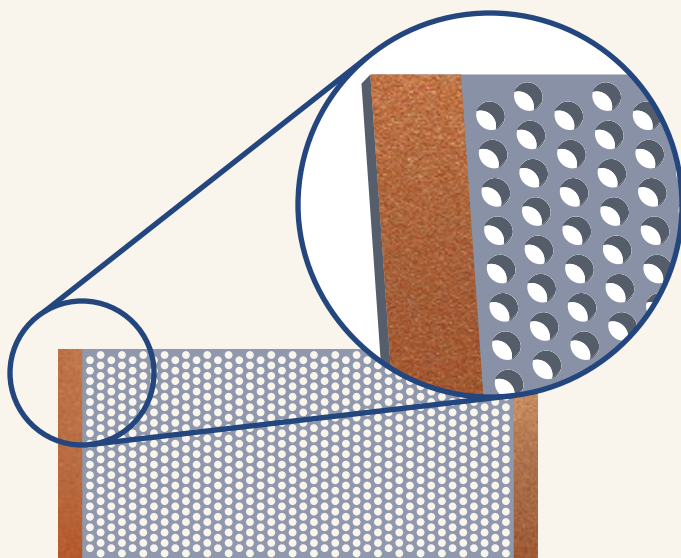


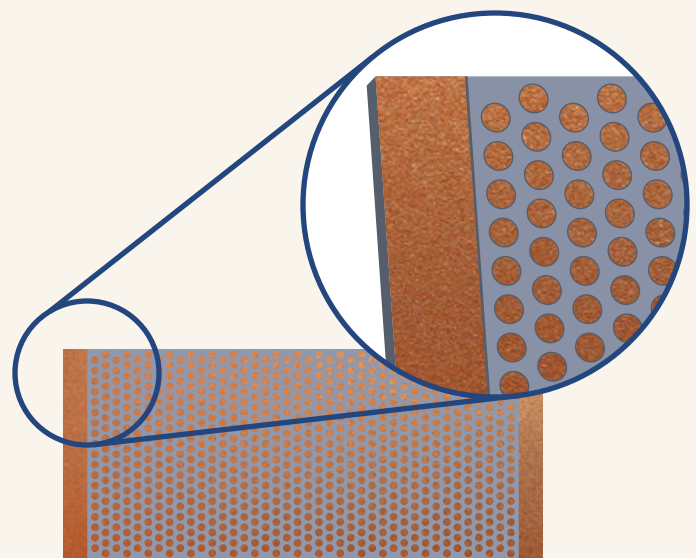
# Macro Tuning Technique for Embedded Resistor Elements

Design Note: Method to adjust a resistor nominal value by use of distributed copper islands or voids within the resistor elements.



$$R_V = \frac{L + \left(\frac{\Sigma A_V}{W}\right)}{W - \left(\frac{\Sigma A_V}{L}\right)} * R_S$$

**Image 1** Planar resistor with voids in body



$$R_I = \frac{L - \left(\frac{\Sigma A_I}{W}\right)}{W + \left(\frac{\Sigma A_I}{L}\right)} * R_S$$

**Image 2** Planar resistor with copper islands in body

- Applications**
- Embedded, large format resistive heaters
  - Laminated metamaterial construction
  - Frequency selective surfaces, high impedance surfaces, EM absorbers, Salisbury screens