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## **TCR<sup>®</sup> Thin Film Embedded Resistor Foil Etching Process Recommendations Using Cupric Chloride for Nickel Chromium (NiCr) Resistive Material**

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### **TECHNICAL BULLETIN**

Nickel chromium resistive material can be selectively removed with various chemistries to give a clean, well defined resistor. Most circuit fabricators use acid etchants, most commonly cupric chloride, for primary image and resistive layer width definition. A second etch step to define the resistor length requires a different chemistry to ensure copper removal without resistive layer etch or degradation. The nickel chromium resistive material layer will exhibit a matte grey finish after defining the resistor image. The processing can be properly controlled provided attention is paid to several considerations.

#### *What to Consider*

The first consideration is ensuring proper chemistries for the resistor defining processing. A solution made up of commercially available cupric chloride and hydrochloric acid is recommended for copper and nickel chromium during resistor width definition. The chemistry removes the copper and minimizes the amount of undercut of the copper and nickel chromium.

The second consideration is the proper chemistries for selective copper removal to define resistor length. A solution made up of commercially available ammoniacal etchant is the preferred chemistry for this process. The ammoniacal chemistry selectively etches the copper leaving the resistive layer intact.

The last consideration is the method of application of the etching chemistry. The removal of the copper and nickel chromium can be performed in either a spray chamber or dip tank. The spray chamber method is preferred to better control etch rates and circuit definition. The temperature and dwell time in the chemistry is solution dependent.

#### *Conclusions*

The copper and nickel chromium components can be completely removed with excellent circuit definition when care is taken to follow the considerations.

Other chemistries are known etchants of copper and nickel chromium. When using other chemistries to remove copper and Nickel Chromium other than recommended above, consult the Ticer Technologies Technical Marketing or Research and Development.

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## Copper and Nickel Chromium Resistive Material Removal Chemistry and Processing Parameters





<b>Etch 1 Solution</b> Copper & Nickel Chromium removal Resistor Width definition	200 g/l CuCl <sub>2</sub> 60g/l HCl
Temperature:	120° F (52° C)
Method:	Spray chamber or dip tank
Time:	Adjust for proper etching of copper weight
<b>Etch 2 Solution</b> Selective Copper removal Resistor length definition	267g/l NH <sub>4</sub> Cl 1 g/l ortho-phosphoric acid 392 ml NH <sub>4</sub> OH 10 g/l CuCl <sub>2</sub>
Temperature:	130 - 140° F (54 - 60° C)
Method:	Spray chamber or dip tank
Time:	Adjust for proper etching of copper weight

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# Etching Sequence of Nickel Chromium (NiCr) Resistive Materials

-  Photoresist
-  ED copper foil
-  Resistive layer
-  Dielectric

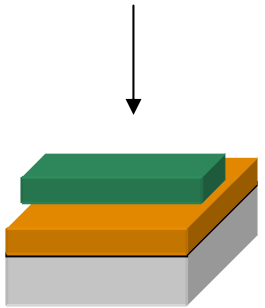
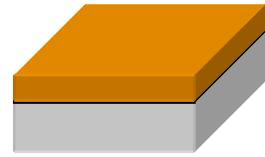
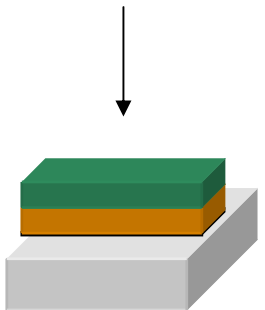
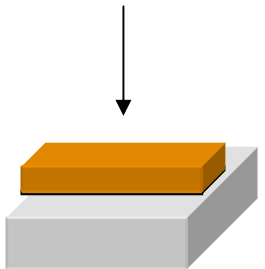


Image 1 Define Width  
Apply photoresist  
Expose  
Develop



Etch 1 Remove Cu and Ni/Cr resistive layer  
200 g/l CuCl<sub>2</sub> and 60g/l HCl  
120°F



Strip photoresist

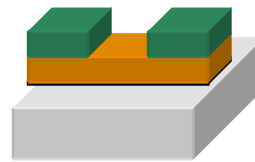
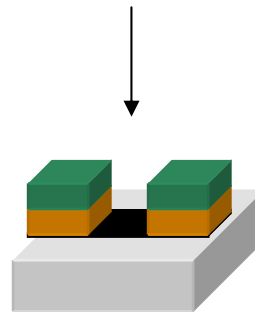
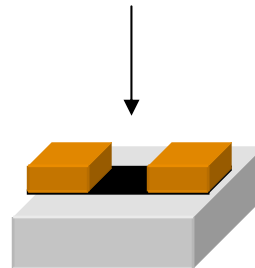


Image 2 Define Length  
Apply photoresist  
Expose  
Develop



Etch 2 Selective copper removal  
Ammoniacal etching solution  
267g/l NH<sub>4</sub>Cl, 1 g/l ortho-phosphoric acid, 392 ml NH<sub>4</sub>OH and 10 g/l CuCl<sub>2</sub>, 140F



Strip photoresist



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