Ticer Technologies
2555 West Fairview St. Suite 101
Chandler, Arizona USA 85224
Tel: (480) 223-0890 Fax: (480) 782-1720
www.ticertechnologies.com

TCR® Thin Film Embedded Resistor Foil Etching Process Recommendations Using HCl/Glycerin for Nickel Chromium Aluminum Silicon (NiCrAlSi) Resistive Material

TECHNICAL BULLETIN

Nickel chromium aluminum silicon 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 aluminum silicon 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. Commercially available cupric chloride and hydrochloric acid or ammoniacal etchants are recommended for copper during resistor width definition. The chemistry removes the copper and minimizes the amount of undercut of the copper.

The second consideration is ensuring proper chemistries for the resistor defining processing of the NiCrAlSi. A solution made up of concentrated hydrochloric acid, glycerin, and water is the preferred chemistry for this process. The chemistry removes the NiCrAlSi and minimizes the amount of undercut of the copper and NiCrAlSi.

The third 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 NiCrAlSi 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 NiCrAlSi components can be completely removed with excellent circuit definition when care is taken to follow the considerations.

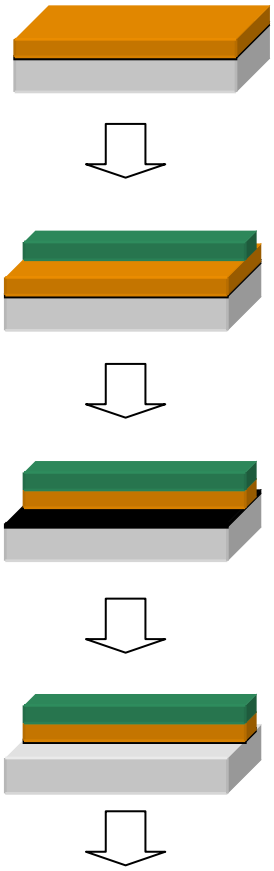
Other chemistries are known etchants of copper and NiCrAlSi. When using other chemistries to remove copper and NiCrAlSi other than recommended above, consult the Ticer Technologies Technical Marketing or Research and Development.

Copper and NiCrAlSi Resistive Material Removal
Chemistry and Processing Parameters

Etch 1 Solution Copper removal Resistor Width definition	267g/l NH_4Cl 1 g/l ortho-phosphoric acid 392 ml NH_4OH 10 g/l $CuCl_2$
Temperature:	130 - 140º F (54 - 60º C)
Method:	Spray chamber or dip tank
Time:	Adjust for proper etching of copper weight
Etch 1 Solution Alternate Copper removal Resistor Width definition	 200 g/l $CuCl_2$ 60g/l HCl
Temperature:	120º F (52º C)
Method:	Spray chamber or dip tank
Time:	Adjust for proper etching of copper weight
Etch 2 Solution Selective NiCrSiAl removal Resistor Width definition	43 volume% HCl (Hydrochloric Acid, 36.5-38%) 46 volume % glycerin 11 volume% water 10 parts per million Thiourea
Temperature:	150º F (66º C)
Method:	Spray chamber or dip tank
Time:	Adjust for proper etching of NiCrAlSi ohms/square
Etch 3 Solution Selective Copper removal Resistor length definition	267g/l NH_4Cl 1 g/l ortho-phosphoric acid 392 ml NH_4OH 10 g/l $CuCl_2$
Temperature:	130 - 140º F (54 - 60º C)
Method:	Spray chamber or dip tank
Time:	Adjust for proper etching of copper weight

Revised 02/09 Technical Bulletin #03-0006

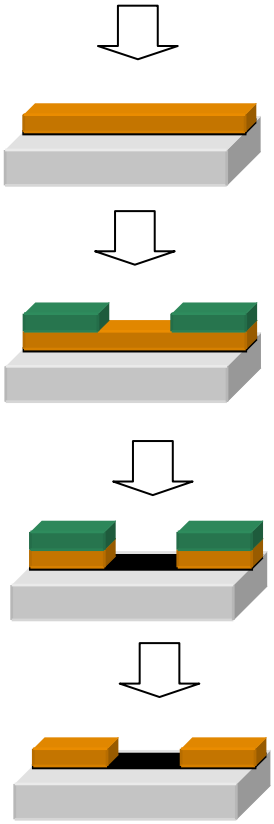
Etching Sequence of Nickel Chromium Aluminum Silicon (NiCrAlSi) Resistive Materials



Define Width
Apply photoresist
Expose and develop

Remove Cu
Etching solution 1

Remove resistive layer
Etching solution 2



Strip photoresist

Define Length
Apply photoresist
Expose and develop

Selective copper removal
Etching solution 3

Strip photoresist

Revised 02/09 Technical Bulletin #03-0006