



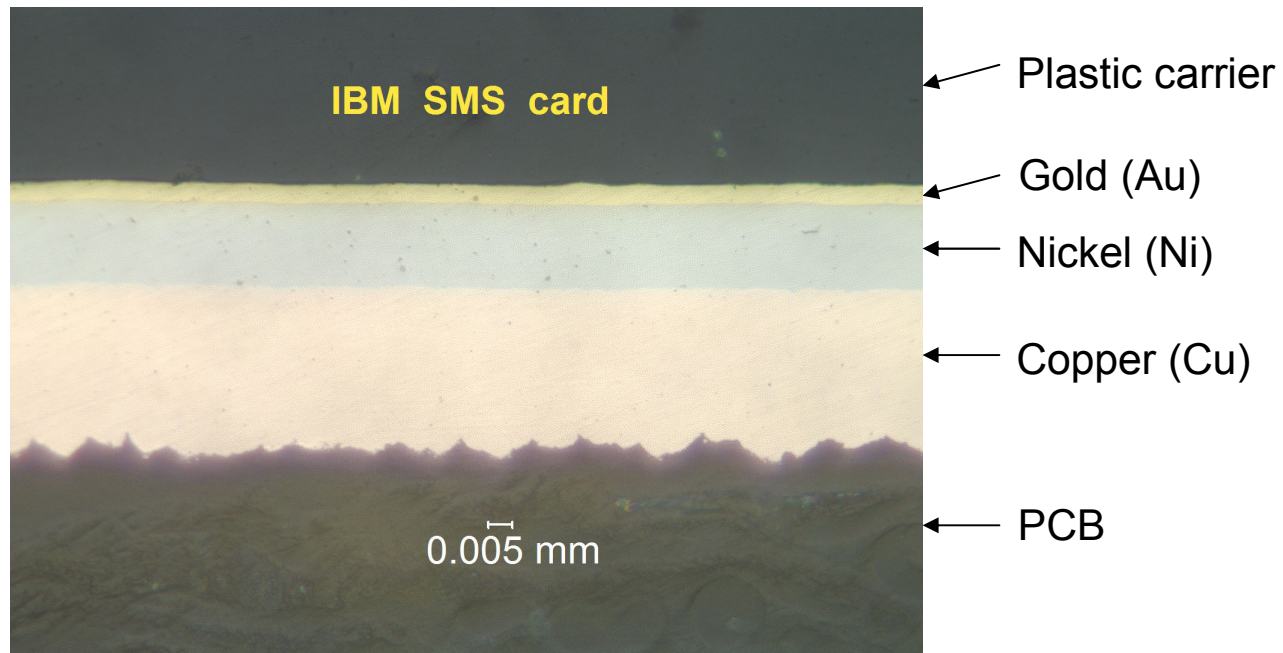
S&T Group Materials Laboratory

1960's SMS Card Connector Tabs

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SMS Card Connector Tab Layers



Types of Analysis Performed

- **SEM – Scanning Electron Microscopy**
 - Measure surface porosity
 - Reveal evidence of excessive surface wear
- **EDX – Energy Dispersive X-ray fluorescence (XRF) analysis**
 - Determine Gold (Au) layer thicknesses
 - Reveal whether Nickel (Ni) diffused to surface or otherwise exposed due to excessive surface wear
- **Cross-sectional analysis**
 - More accurate determination of Nickel thickness layer

Analysis Conclusions

- **EDX and cross-sectional analysis show a thick ~100 μ -inch contact plating of Au over ~750 μ -inch Ni.**
- **SEM showed no measurable porosity in the Au plating.**
 - No exposed nickel or copper detected.
 - “Gold plating is too thick to have porosity.”
- **SEM showed no evidence of excessive contact force or deep wear marks.**

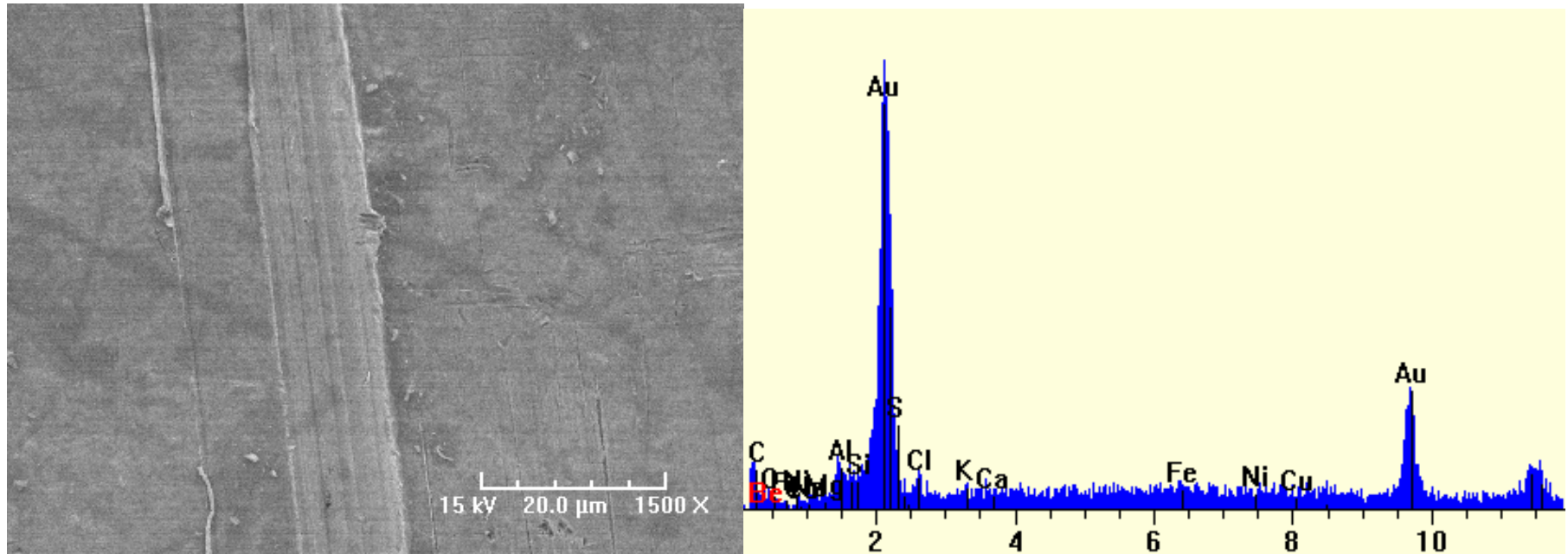
Maintenance Recommendations

- **No need to lubricate the SMS connector tabs.**
- **The connector tab surfaces can be mechanically cleaned with lint-free cloth soaked in isopropyl alcohol (IPA).**

Contact tabs are numbered from left to right: Plating thicknesses measured using x-ray tool

Contact tab location	IBM		TRANSCO	
	Au μ -inch	Ni μ -inch	Au μ -inch	Ni μ -inch
1	124	329	138	652
3	108	295	112	416
5	105	275	108	402
7	107	308	108	413
9	96	284	106	389
11	100	300	106	429
13	101	285	108	404
14	132	570		
15			117	451
16			141	933

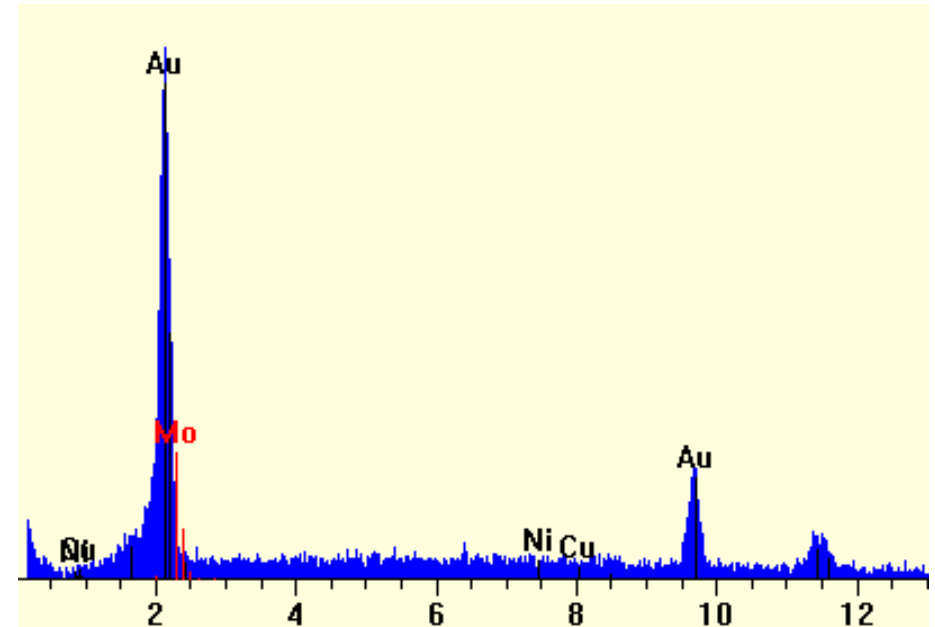
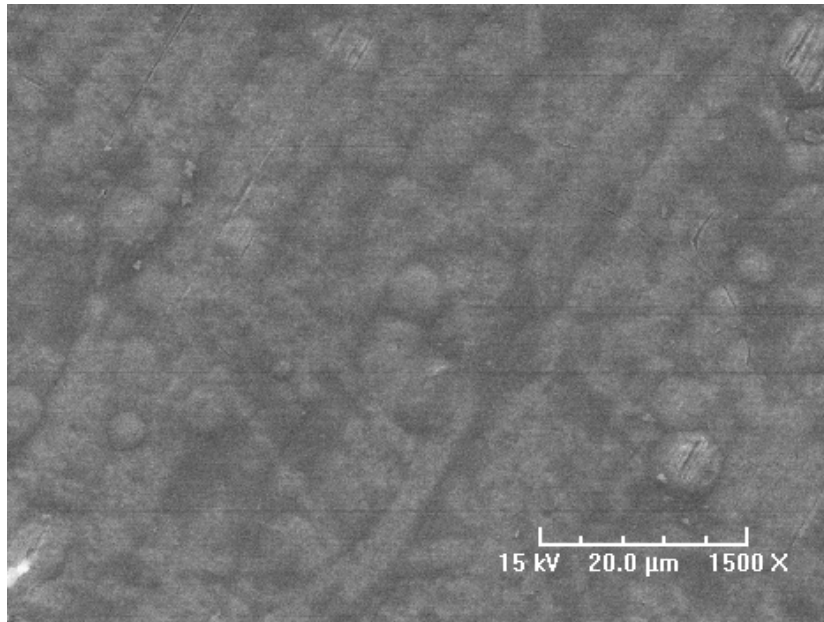
SEM/EDX: Contact tabs on TRANSCO card



No porosity was apparent when the plating was examined in a SEM at 20kV accelerating voltage.

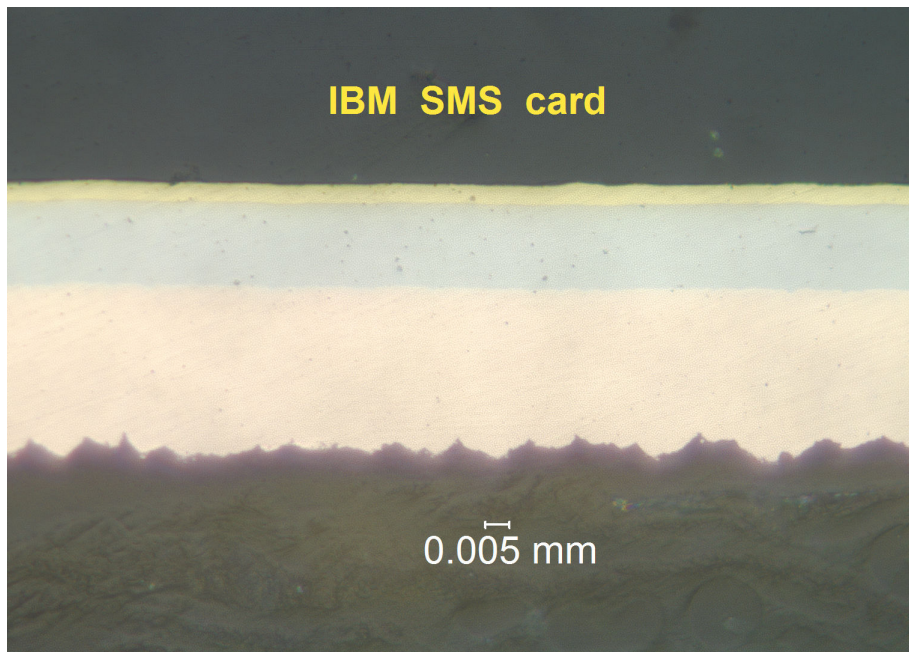
EDX: Some S, Cl, K and Ca contamination was seen.

SEM/EDX: Contact tabs on IBM card



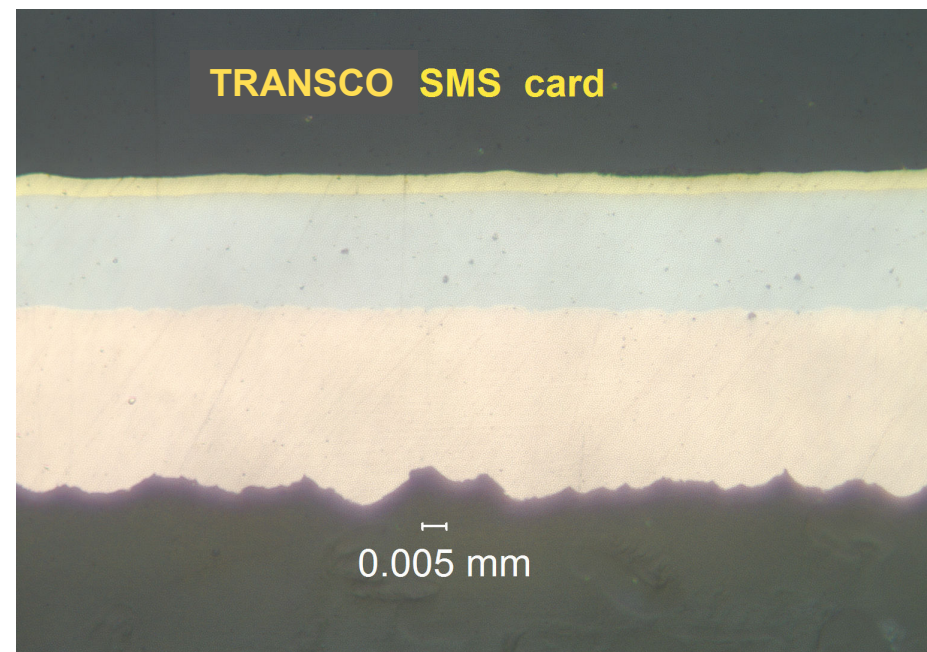
No porosity was apparent when the plating was examined in a SEM at 20kV accelerating voltage.

Cross Sectional Analysis



IBM SMS Card

Au = 100 μ -inch, Ni=750 μ -inch



TRANSCO SMS Card

Au = 150 μ -inch, Ni=950 μ -inch

Notes by PJ Singh

- For determining Ni thickness, cross-section method is more accurate, but for Au thickness, EDX (X-ray) method is better.
- In the bygone days, ATT and others thought that connectors needed many microns of gold plating with nickel underplate. Today 3/4 micro-meter of gold with nickel underplate does a good job.
- I am not in favor of contact lubricants for gold platings. One micrometer gold plating with nickel underplate, with high contact force and no vibration needs no lubricant. Lubricant complicates connector reliability because one cannot predict the long-term chemical behavior of lubricants.
- Computers in data centers are exposed to 40-50%RH clean air at less than 20 deg C. Generally, metallic corrosion is not a concern below 50% RH.