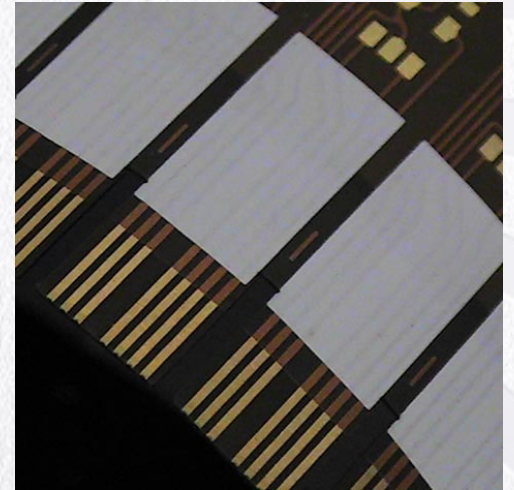
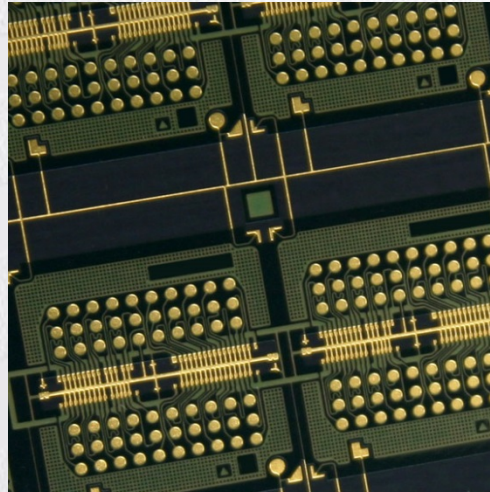
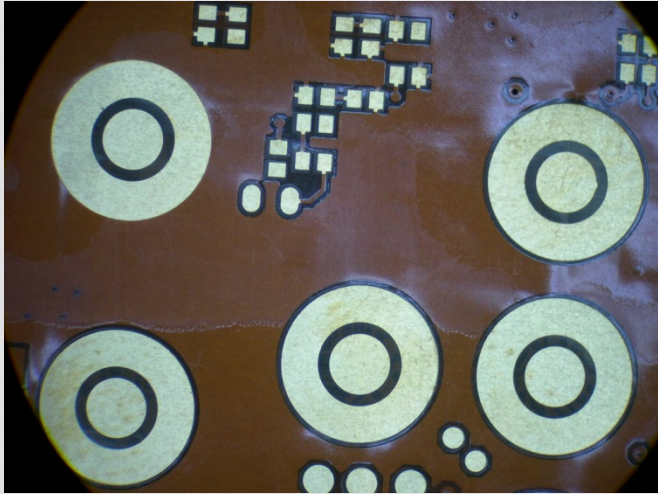


# TechniPad ENEPIG

## Wear Resistance Data



# Measurement Of Wear Resistance Coefficient Of Friction

- Test Method;

- ASTM G133-05

Cycles =,"100"

Wipe Length =,"15","mm"

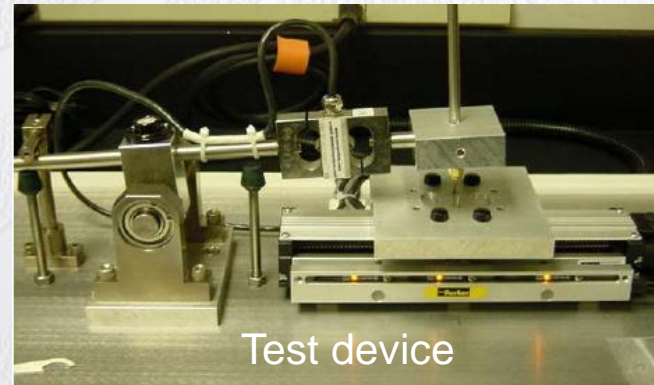
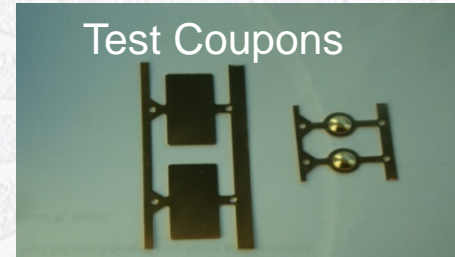
Velocity =,"6","mm/s"

Acceleration =,"150","mm/s/s"

Weight = ,"200","g"

- Test Coupon

- Flat & Dome Connectors
- ENIG Plated with ~2, 8, 22, & 35 micro inches of Pd
- ENIG control

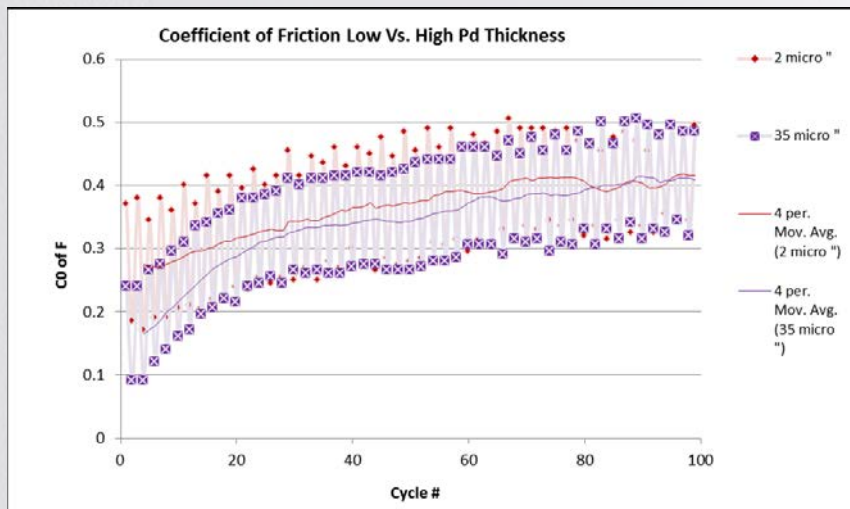




# Coefficient of Friction: Low Pd Thickness vs High Pd Thickness & ENIG

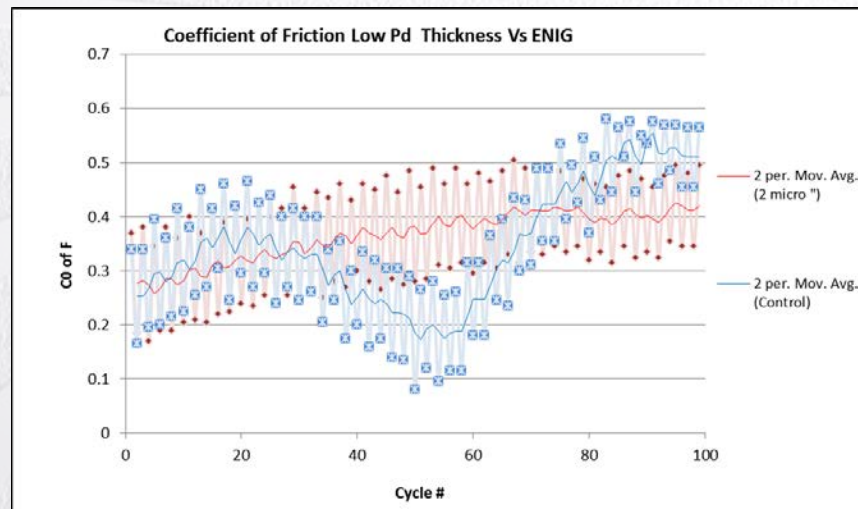
## 2 vs 35 micro-inches Pd

### No difference in CoF



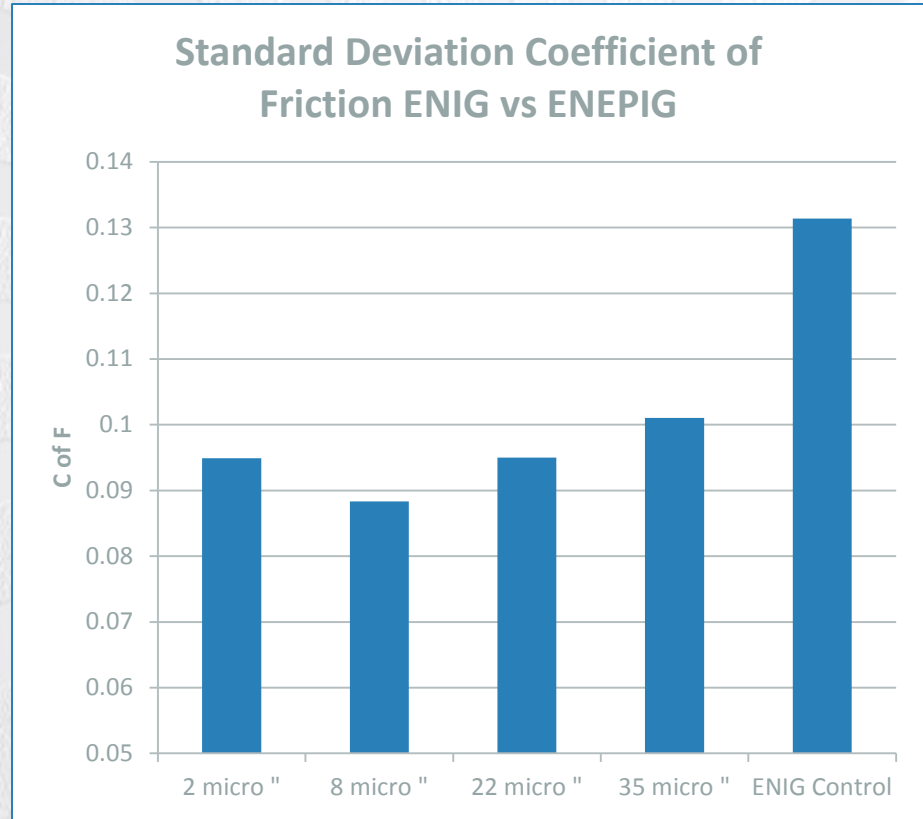
## 2 micro inches Pd vs ENIG

### Ave CoF higher with ENIG & after Au Removal



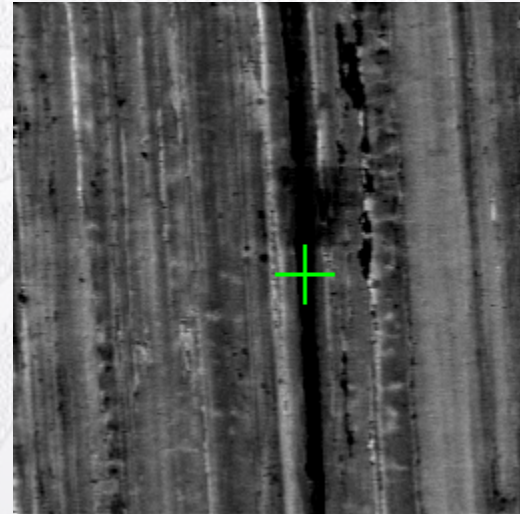
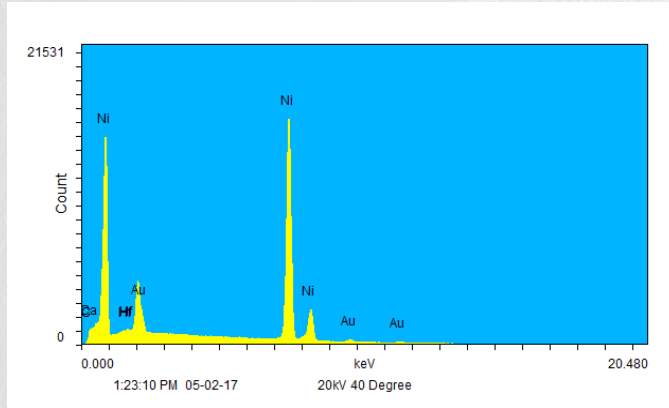
## Summary Coefficient of Friction Data

- Save basic curve shape for all Pd thicknesses
- Much larger variation in coefficient of friction with ENIG
- Standard deviation for ENEPIG with AT7611 all similar
- Standard deviation for ENIG is 40% higher



# SEM/EDS Analysis ENIG Control

- Damage to surface with cracking of deposit
- Au % on surface normally  $> 50\%$  on ENIG

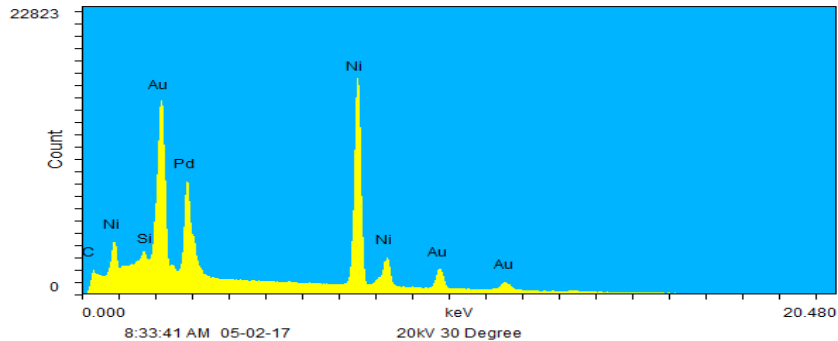


Elements:	WT%	AT%	K_A	K_F	K_Z	Intensity	P/bkg
NiK	91.44	97.29	0.994	1.005	1.016	1646.789	36.8
AuL	8.56	2.71	0.979	1	0.751	17.207	0.5



# SEM/EDS Analysis ENEPIG ~2 micro inches Pd

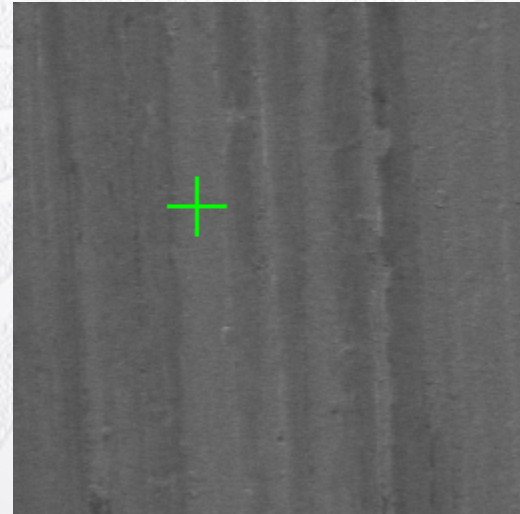
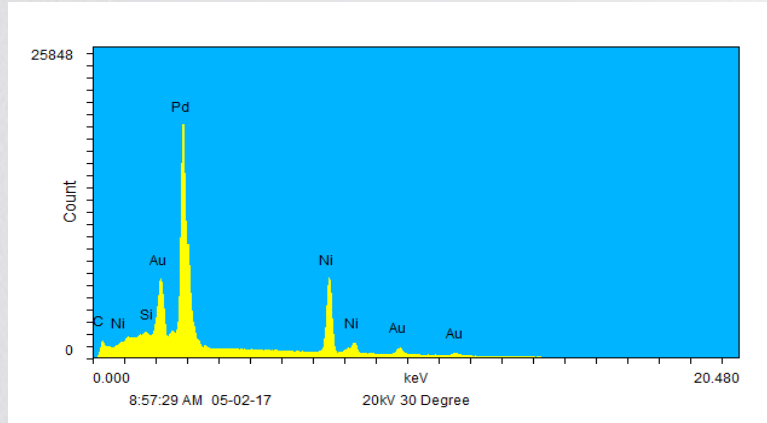
- No knurling or cracking of deposit
- High % Ni showing indicating wear through at this Pd thickness



Elements:	WT%	AT%	K_A	K_F	K_Z	Intensity	P/bkg
AuM	39.28	19.02	0.929	1	0.878	806.765	5.5
PdL	24.25	21.74	0.745	1	0.975	267.761	2.1
NiK	36.46	59.24	0.956	1.022	1.127	851.892	13.8

# SEM/EDS Analysis ~8 micro inches Pd

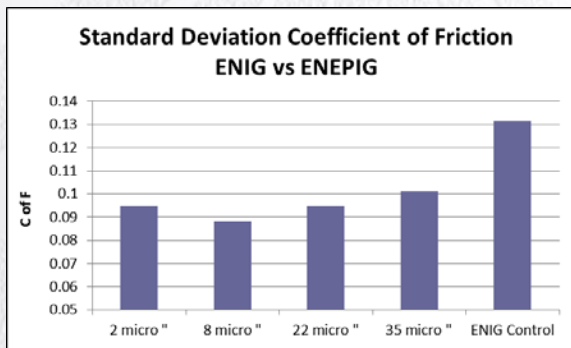
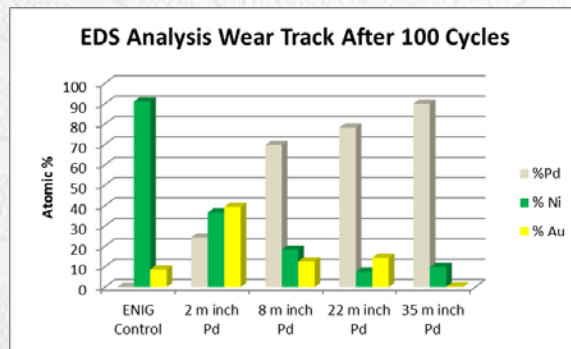
- Pd appears to smear similar to hard gold
- %Ni cut by 50% over 2 micro inch sample



Elements:	WT%	AT%	K_A	K_F	K_Z	Intensity	P/bkg
AuM	12.06	5.96	0.965	1.001	0.883	346.897	2.2
PdL	69.67	63.74	0.903	1	0.982	1259.064	11.2
NiK	18.27	30.3	0.945	1.007	1.131	559.355	9.8

# Summary: TechniPad ENEPIG Wear Resistance Testing

- CoF on ENEPIG with AT7611 is consistent even with variation in Pd thickness.
- Ni exposure is minimal as Pd thickness reaches 10 micro inches
- Pure Pd deposit from TechniPad AT7611 provides some lubricity similar to a hard gold deposit





# THE SOLUTION: TechniPad ENIG & ENEPIG

- **Outstanding Assembly Performance**
  - Flat EN = No black pad/corrosion products on EN Surface
  - Proprietary immersion gold process with almost no Ni removal
  - Thin intermetallic
- **Lowest Operating Cost**
- **Solves ENIG Process Issues**
- **All Interconnect Applications**
  - Low contact & good wear resistance
  - Wire bondable
  - Solderable

