

CLEANING LABORATORY EVALUATION SUMMARY

SCL #: 2006
 DateRun: 03/29/2006
 Experimenters: Jason Marshall
 ClientType: Chemical Company
 ProjectNumber: Project #2
 Substrates: Gold
 PartType: Coupon
 Contaminants: None
 Cleaning Methods: Immersion/Soak
 Analytical Methods: Gravimetric, Visual
 Purpose: To evaluate Gold Etch Kit

Experimental Procedure: PREPARING THE COUPONS
 The contents of the cleaning powder (Alconox) was emptied into a 500 ml glass beaker. Warm water (100 F) was added to the beaker until a volume of 250 ml was reached. The mix was stirred with a clean glass rod until the powder was dissolved. Using the plastic tweezers provided, the gold coupons were individually immersed and agitated in the cleaner solution for approximately 30 seconds. The coupons were removed and rinse with deionized water from the plastic dispensing bottle over the 2nd beaker, taking care not to handle the gold surface of the coupons with ungloved hands. The coupons were allowed to air-dry on the paper towels, gold surface face-up for approximate 30 minutes.

ETCHING THE COUPONS*
 The entire bottle of the AU-1 Gold Etchant bottle was emptied into a 1500 ml beaker. Warm deionized water (100 F) was slowly added until a volume of 1000mL was reached. The mix was stirred gently with a clean glass rod until all the material was dissolved. Each coupon was immersed and etched for 10 minutes. Following etching, the coupons were removed and set aside.

*Heating the solution further ,maximum 180 F, will increase the rate of etching.

REMOVING THE GOLD*
 The GoldOut™ was slowly added to the etchant solution while stirring with a clean glass rod. Effervescence was noted to occur and was contained using Parafilm. The process was considered complete when the initial dark red color of the solution turned to a pale yellow color. The precipitate containing the gold was expected to settle-out in approximately five minutes and can be removed from solution by filtration. A glass fiber filter was used to collect the precipitated gold.

*Enough GoldOut™ has been supplied to process 1000mL 'spent' AU-1 etch solution.

In addition to the prescribed directions for the Test Kit, the lab attempted to determine the amount of gold etched from the coupons and the amount of gold collected in the filtration process. Gold loss was determined through gravimetric analysis, comparing the initial weight to the etched weight. Likewise the amount of gold collected was determined by weighing the glass fiber coupon before and after filtration. The coupon was allowed to dry for 24 hours before the final weight was recorded.

Results: The Etch Test Kit was found to remove a fair amount of gold within the 10 minutes of immersion of the gold coupons. The table below lists the initial and final weights of the coupons. Additionally the table includes the amount of gold lost from the coupons.

Initial Coupon wt	Loss	% wt change	
6.5447	0.1726	2.64	
6.5937	0.1620	2.46	
6.6826	0.1467	2.20	
6.6070	0.1604	2.43	Ave

From this, an anticipated rate of etching could be determined for the Test Kit when conducted at 100 F. The rate divided the average weight loss in mg by the time of immersion in minutes for a Etch Rate of 16mg/min.

$$\text{Etch Rate} = (0.1604 \text{ g} * 1000\text{mg/g})/10\text{min} = 16.04 \text{ mg/min}$$

After filtration the amount of gold collected was determined by weighing the dry filter. The weight loss for the three coupons were combined to determine the total gold removed from the coupons. The amount of gold collected by the filter was then divided by the total gold lost to determine recovery. The glass filter used collected just over 75% of the gold.

Total loss 0.4813
 Recovered 0.3688
 % Recovery 76.63 = (0.3688/0.4813)*100

Summary:

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Conclusion: The etch kit was shown to remove gold and then allow for the gold to be easily recovered through filtration.