CUPOSIT® ELECTROLESS NICKEL NL-61
(4X Concentrate)

ELECTROLESS NICKEL NL-61 has been specifically formulated to deposit an adherent, corrosion-resistant, nickel-phosphorus alloy rapidly onto metallic and non-conductive surfaces, including steel, copper, aluminum and their alloys; as well as plastics, glass and ceramics. The bath is sufficiently stable to be maintained at operating temperature all day long for extended periods whether or not work is being processed. In addition to the usual advantages of electroless nickel processes, the major benefits offered by NL-61 are:

1. Indefinite bath stability at temperatures up to at least 210°F.
2. High speed deposition at 195-200°F with correspondingly rapid rates at lower temperatures.
3. Simplicity of initial bath make-up. Dilute the NL-61 MAKE-UP CONCENTRATE with water. pH adjustment and dummying of the bath are not required.
4. Simplicity of replenishment. Replenishable for more than four complete bath depletions with corresponding economy and ease of operation. Bath is replenishable at operating temperature.
5. Simplicity of equipment required. Initial investment and maintenance are low.
6. Simplicity of bath control. Replenishers are designed to maintain bath concentration and pH within acceptable limits. Control is based solely on determination of approximate nickel content. Bath has a wide replenishment range.
7. Wide area to volume tolerance. Economical tank loading.
8. Yield from one gallon of working bath with four complete regenerations of the original nickel concentration is approximately 6 milfeet* of nickel-phosphorus alloy.

*1 milfoot is equivalent to 1 sq. ft. of surface area plated to a thickness of 1 mil (.001").

ELECTROLESS NICKEL NL-61 is supplied as a concentrated solution which, after dilution with water, is immediately ready for operation. Replenishment is made, as required, directly to the bath at operating temperature.

SHIPLEY COMPANY INC.

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CHARACTERISTICS OF THE DEPOSIT

1. Chemical Analysis: 91 - 93% nickel (remainder - chiefly phosphorus) over a range of four complete regenerations.

2. Hardness (as Plated): Rockwell (C scale) 47 to 51 over a range of four complete regenerations.

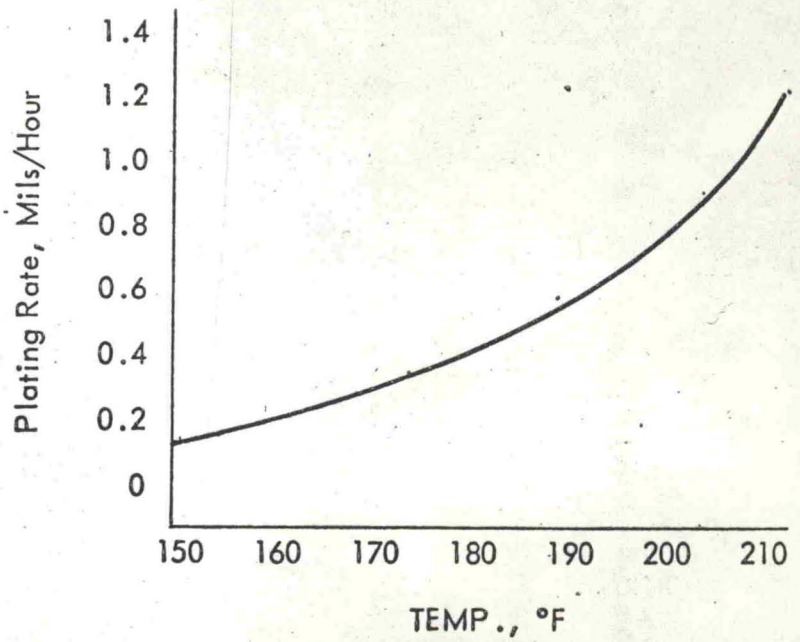
3. Adhesion: 17 mil Kovar wire with 0.2 mil electroless nickel plate when bent around its own diameter showed some cracking but no detachment of plate. Excellent bonds are obtained on other properly prepared substrates.

4. Corrosion Resistance: An electroless nickel plating of 0.2 mil thickness on a properly prepared steel substrate shows no rust spots in boiling aerated water after 15 minutes.

CHARACTERISTICS OF THE PROCESS

1. PLATING RATE AS FUNCTION OF TEMPERATURE (WITH FRESH BATH):

Bath Temp., °F	Approx. Thickness in 60 minutes, mils
150	0.15
160	0.2
170	0.3
180	0.4
190	.55
200	.75
210	1.2



3. PLATING RATE AS A FUNCTION OF POT-LIFE AT 200°F (WITHOUT REPLENISHMENT):

A bath has been operated for 25 eight-hour periods at 200°F. The plating rates remained comparable to a fresh bath with corresponding nickel depletion. The effect of prolonged high temperature operation appears to have no effect on rate or stability. This makes it possible to operate the bath in a manner similar to an electroplating bath with power turned on in the morning and off at night; the bath being available for instant use, as required.

EQUIPMENT

ELECTROLESS NICKEL NL-61 may be operated in suitable plastic equipment or in standard glass or glass-lined equipment. Jacketed vessels are not required nor recommended. Heating is easily obtained with quartz or stainless steel immersion heaters as well as stainless steel platecoils, using adequate mechanical stirring. Temperature controls are required to maintain operating temperature. Filtration may be necessary for some applications. For recommendations on specific applications, contact the Shipley Customer Service.

1. When using stainless steel as the tank material, the tendency toward plate out on the stainless is reduced by applying an anodic charge of 2 to 4 milliamps per square foot of tank surface. The cathode material can be 1/4 inch stainless steel rod and should be enclosed in Dynel bags for optimum performance.

   The cathode to anode surface area is approximately 1:72.

2. Prior to the bath make-up, the stainless steel vessel should be passivated with 50% by volume Nitric Acid, preferably overnight.

OPERATION

MAKE-UP:

One part by volume of the NL-61 4X Concentrate is diluted with 3 parts by volume of distilled water. The bath is then ready for use upon heating to operating temperature. (NOTE: the NL-61 3X Concentrate can be used instead of the NL-61 4X Concentrate; if so, the 3X Concentrate is diluted with 2 parts by volume of distilled water.)

OPERATING CONDITIONS:

Depending on the deposition rate desired or on the temperature sensitivity of the basis material, the bath may be operated over a wide range of temperature, up to and including the boiling point. For most purposes, it is recommended that the bath be operated at 185-195°F. The bath may be maintained at operating temperature for extended periods of time without spontaneous decomposition. The ratio of work area to bath volume can be as high as 1 square foot per gallon, depending on the operating temperature. For example:

Operating Temp., °F	Suggested Loading, Square Feet per gallon
210	0.2
200	0.3
190	0.5
180	1.0

Favorable tank surface area to volume ratio would permit increased work load. Frequency of replenishment will be determined at given operation conditions by the work area to bath volume ratio; i.e., larger area to volume ratio requires more frequent replenishment.

For optimum results, operate the bath with constant agitation and filtration.

Maintain bath volume with distilled water to compensate for water loss due to evaporation. Constant level controls may be used.

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MAINTENANCE:

Replenishment additions are based solely on nickel analysis of the bath. Analysis may be by standard titrimetric methods for nickel or by the following simple colorimetric procedure:

1. To 40 ml of the plating bath, add 40 ml of NL-61 COLOR INDICATOR SOLUTION and mix well.

2. Determine approximate nickel concentration by comparison with the standards supplied. Discard sample solution after nickel determination is complete (do not return to plating bath).

After determination of nickel concentration, replenish with 1 part of NL-61 "R" REPLENISHER and 2 parts NL-61 "S" REPLENISHER as shown below:

REPLENISHMENT SCHEDULE

Ni ANALYSIS			
% Ni based on original nickel content of bath	Ni concentration, gram/liter (as metal)	Add NL-61 "R" REPLENISHER, per gallon of bath	Add NL-61 "S" REPLENISHER, per gallon of bath
100	7.1	-	-
90	6.4	25 ml	50 ml
80	5.7	50 "	100 "
70	5.0	75 "	150 "
60	4.3	100 "	200 "

IMPORTANT: For best results, maintain the nickel concentration between 80% and 100% do not allow nickel concentration to fall below 60% or to increase above 110%.

Wide operating limits are built into the bath so that precise nickel determination is not required. The bath can be regenerated completely four times before the bath should be discarded. One complete regeneration has been accomplished when 250 ml of "R" and 500 ml of "S" have been added per gallon of plating bath.

For maximum ease of replenishment, add the "R" REPLENISHER directly to the operating bath and follow with slow addition of "S" REPLENISHER. Vigorous agitation is recommended during addition to avoid localized over-concentration of replenishment solutions.

For repetitive work, replenishment can be made on a predetermined or continuous addition basis with sufficient accuracy for most applications. Occasional checks on nickel concentration are necessary under these circumstances to correct variations.

28 1/2
9 1/2
38

3 12
38