Advice & Counsel

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Keys to the Exam

Before I took the CEF exam in the early 1970s, many thoughts raced through my head. What happens if I don't pass? Will my employer become unhappy with me? Will my associates and/or customers think I don't know my job well enough?

It was enough to run beads of sweat on my forehead, and made for an unpleasant two hours of answering questions and working problems. Of course, as the exam progressed, I felt much better and I did pass.

Several years later, I asked the owner of a plating shop why he was not a CEF and his reply was that it would be too embarrassing, should he not pass. I had another experience with a student in one of my classes who stated that she better pass the exam or she had no job.

These past experiences have caused me to write a series of articles in the hope that I will alleviate some of the anxiety an AESF examination can cause, beginning with the "big momma," or CEF exam.

Overview

The CEF exam dates back to the late 1960s, shortly after Dr. Don Swalheim, CEF (deceased) created the AESF Training Course in Electroplating (now called the Regular Training Course in Surface Finishing). The exam was and still is meant to verify a broad base of basic knowledge in surface finishing topics. While the bulk of the exam has not changed since its inception, changes have been made to reflect new and to delete dated topics.

Since its inception, more than 3000 individuals have succeeded in passing this exam and becoming CEFs (Certified Electroplater Finisher).

The current version of the exam has 188 questions and 12 problems which must be completed in a two-hour time frame with only a basic calculator and pen or pencil in hand.

Each question is worth one point. The value of a given problem is indicated after the question number (they add up to

30 points). If no value is indicated, it is a one-point problem. The total of all available points is 188 + 30 = 218. You need 0.7 × 218 = 153 points to pass this exam. To date, no individual has obtained a perfect score on this exam. Mr. Chuck Goodrich, CEF (deceased) holds the record for highest score. He missed a single ½-point question.

The exam can be taken by anyone who feels qualified to be a CEF. It is offered after any AESF Foundation course, even if the course is not related to the CEF. The exam is also offered at each SUR/FIN (typically the Friday of SUR/FIN week). A CEF candidate needs to complete an application and pay a fee (contact AESF Foundation at www.nasf.org).

For candidates who can not readily travel to an exam site, AESF Foundation may arrange to have the exam "proctored." This is usually done at a local AESF branch but has also been coordinated with a university or community college on occasion.

Key-1

The exam covers a broad range of metal finishing topics in 23 categories, making study critical to success. Fortunately, AESF provides guidance in their course materials in the form of "review quizzes." The review quizzes are designed to prepare a candidate for the exam. The format of questions and topics are similar to what you can expect on the exam. Of course the review questions are not exact duplicates of the exam questions, and the subject matter may be altered slightly, but a candidate who is able to answer more than 70% of the review questions should feel properly prepared to take the exam. The AESF Foundation offers both classroom and home study instruction for individuals wishing to better prepare for the exam.

Key-2

The exam provides the candidate with two tables of data. The first contains chemical elements, symbols and atomic weights. The second table contains commonly plated metals, their densities, common valences and Faraday factors. Therefore, such data need not be memorized. However, the exam does require the candidate to "know" a number of mathematical formulas used in the industry, so the following do need to be memorized and their application needs to be known.

Equations to memorize:

1.

$$V_a \times N_a = V_b \times N_b$$

where
V_a = volume of acid
N_a = normality of acid
V_b = volume of base and
N_b = normality of base

This equation is used in calculating acid-base neutralization titrations. For example, if 20 cc of a solution of sulfuric acid is neutralized by 5 cc of 1N sodium hydroxide, use this equation to calculate the normality of the acid.

2.

$$I = \frac{E}{R} \qquad \textbf{(Ohm's Law)}$$

where
I = current in amperes
E = voltage and
R = resistance in ohms and
Watts = Amps x Volts, used for calculating power consumption.

This equation is used to calculate current, voltage or resistance in a simple electrical circuit when two of the three parameters in the equation are known. For example, what voltage is required to produce 10 amperes in a DC circuit with a resistance of 3.0 ohms? What wattage would this circuit utilize?

3.

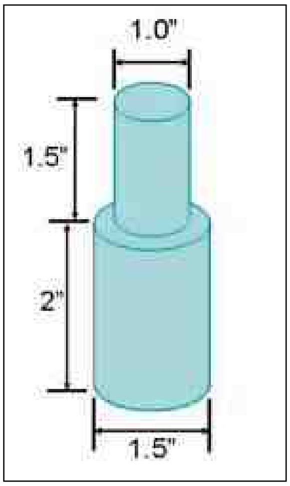
$$F = D\left(\frac{C_t}{C_r}\right)$$

This equation is used to calculate the water flow in a single ideal rinse tank. For example, if a rinse tank is flowing at 3.0 gpm (F) and the concentration of nickel in the process (C_t) is 75 g/L, and the drag-in rate (D) is 0.02 gpm, what is the concentration of nickel in the single ideal rinse (C_r)?

4.

Area of a Circle	$A = \pi r^2$
Area of a Cylinder	$A = \pi dh$

These equations are used to calculate the surface area of a geometric shape. For example, calculate the surface area of the following geometric shape



5.

$$T_1 \times Eff_1 = T_2 \times Eff_2$$

where

T_1 = plating time at first efficiency, Eff_1 = % efficiency 1 and
T_2 = plating time at second efficiency, Eff_2 = % efficiency 2.

This equation is used to adjust plating time based on efficiency differences. For example, if a plating process requires 10 minutes at 100% efficiency, how much time will be required to achieve the same thickness at 22.5% efficiency?

6.

$$\frac{96{,}500}{AtomicEquivalentWeight} = \frac{Coulombs}{X}$$

This is a proportional equation relating Faraday's Law to a given plating condition. For example, if 100 amperes of current is applied to a plating cell, operating at 100% efficiency, for 10 minutes, how much nickel will be deposited (in grams)?

7.

$$A \times \frac{Hr}{\mu m} \times m^2 = F$$

where
A = amperes
Hr = Hours of plating time
μm = microns of plating thickness and
m^2 = the surface area of the part or parts to be plated.

This equation allows estimation of plating time (assuming 100% process efficiency) for a given process. For example, how much time will it take to obtain 0.5 μm of nickel on 3.0 m^2 of parts, if we apply 300 amperes of current?

8.

$$t = \frac{Wt}{d \times A}$$

where
t = thickness
Wt = weight of metal deposited
d = density of the metal deposited and
a = area of the part covered by plating.

This equation is used to calculate the average thickness of a deposit on a given area, knowing the density and the weight of the deposited metal. For example, if 3.0 grams of copper are covering 200 cm^2 of surface area, what is the average thickness of the deposit?

For readers who were tempted/challenged to test their CEF knowledge, the **answers to the example problems appear on page 16**.

From the above, it is apparent that a mastery of basic algebra is critical to success on this exam. For candidates that have had algebra 20 years ago and for those candidates who never took algebra, AESF offers a basic lesson on solving such problems as part of our training course.

More keys will be provided in future issues. *P&SF*

Test Your Plating I.Q. #448

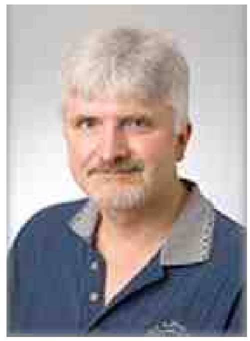
By Dr. James H. Lindsay

Rinsing

1. What are some reasons to reduce rinse water flow?
2. Contrast the reason for rinsing between process tanks with those at the very end of the process.
3. If rinse water flow is reduced for the reasons of question #1, what problems arise and how can they be solved?
4. Rinses can be used for recovery by returning solution to the process tank. What is essential when doing so?
5. How is water quality measured and expressed?

Answers on page 11.

Kulis achieves MSF



Greg Kulis, MSF, Project Engineer for Reliable Plating Works, Inc. (RPW) has achieved the level of Master Surface Finisher. The RPW family is very proud of Greg's accomplishment. This certification process required that he complete six grueling levels of testing through the AESF Foundation. His hard work and dedication to becoming the very best he can be now puts Greg in a very elite group of surface finishing experts. These are the very best and most knowledgeable in the surface finishing industry. He is fluent in plating all types of substrates and coatings, as well as, preplate preparation and post plate treatments. This certification also covers waste treatment.

Greg will be using this knowledge for new and special projects in support of RPW's growth. He will continue to be key in the start up of new business and will be designing and developing the processes which will make these new projects a success for our Customers. He will also be improving existing processes.

Recently Greg also received his Green Belt Certification from the Wisconsin Management Extension Partnership (WMEP) along with three of his fellow RPW employees. He and his team members have helped RPW achieve higher quality, better lead times and avoid the increasing costs of materials and services.

RPW is committed to supporting this growth through education and training of our people. The RPW Family is extremely proud of Greg's accomplishments and congratulates his achievements!

Aluminum Anodizers Council 2008 Board Elections Include New Position, Chairman and Directors

The results of the Council's annual election of Officers and Directors were announced at the Seventeenth Annual International Anodizing Conference and Exposition October 29, 2008 in San Francisco, CA. The AAC Board of Directors, now led by a new Chairman, has three new Directors, including a new position of Professional-Member Director. Terry Snell, Division Manager Environmental Division of Bonnell Aluminum Company, an aluminum extrusion company headquartered in Newnan, Georgia, was elected to his first one-year term as Chairman of the Council. Todd Hamilton of Southern Aluminum Finishing was elected to serve his first term as Vice Chairman/Treasurer.

Prior to the 2008 election, the AAC Board of Directors approved a change to the Council's bylaws, opening up a new seat on the Board for a Professional-Member representative. Anne Deacon Juhl of AluConsult in Denmark will serve a two-year term as Professional-Member Director, representing the consultants to the industry. She brings to the Board more than 15 years of experience working with surface treatment of aluminum.

In addition, two new Directors were elected. Rick Rosenfield of Douglas Alexandria Finishing and was elected to serve his first term as a Firm Director and Thad Piatkowski of Houghton Metal Finishing was elected to serve his first term as a Supplier Director. Firm Director Leonid Lerner of Sanford Process Corporation was re-elected to serve his second two-year-term. Andy Joswiak of Linetec in Wausau, Wisconsin was elected to serve his first one-year term as Past Chair. Gregory T. Rajsky, CAE, once again was elected to serve as President.

The Aluminum Anodizers Council is the international trade association of firms engaged in aluminum anodizing and whose mission it is to support its members—and users of anodized aluminum—through education, advocacy, and promotion. For more information: Phone: (847) 526-2010; Fax: (847) 526-3993; E-mail: mail@anodizing.org; Website: www.anodizing.org. *P&SF*

Advice & Counsel from page 9:
Answers to the example problems:

1. $V_a \times N_a = V_b \times N_b$
   $20 \times N_a = 5 \times 1$
   $N_a = 5/20 = 0.25$

2. $I = E/R$
   $10 = E/3$
   $E = 30$ Volts

3. $F = D(C_t/C_r)$
   $3 = 0.02(75/C_r)$
   $C_r = 0.02(75)/3$
   $C_r = 0.5$ g/L

4. Area of top circle:
   3.14 (0.5 × 0.5) = 0.78 in^2
   Area of bottom circle:
   3.14 (0.75 × 0.75) = 1.77 in^2
   Area of top cylinder:
   3.14 (1 × 1.5) = 4.71 in^2
   Area of bottom cylinder
   3.14 (1.5 × 2) = 9.42 in^2
   Area of annular ring in middle:
   1.77 – 0.785 = 0.98 in^2
   Total area
   = 0.78 + 1.77 + 4.71 + 9.42 + 0.98
   = 17.66 in^2

5. $10 \times 100 = T_2 \times 22.5$
   $T_2 = 1000/22.5 = 44.4$ min

6. 100 A × 10 min × 60 sec/min = 60,000 coulombs
   Equivalent weight of nickel = 58.7/2 = 29.4 g
   $96,500/29.4 = 60,000/X$
   $X = (60,000 \times 29.4)/96,500 = 18.28$ g

7. $A \times Hr/\mu m \times m^2 = F$
   $(300 \times Hr)/(0.5 \times 3) = 8$
   $Hr = (8 \times 0.5 \times 3)/300 = 0.04$ hr or 2.4 min)

8. $t = Wt/(d \times A)$
   $t = 3/(8.9 \times 200)$
   $t = 0.00168$ cm or 16.8 microns)