

Purple Epoxy-Coated Reinforcement: Does Color Make a Difference?

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Although ASTM A775¹ (green) reinforcement is the most commonly specified epoxy-coated reinforcement (ECR), there has recently been a slight uptick in the specification of ASTM A934² (purple) ECR, which begs the question: “What’s the difference?” Most engineering school programs do not even introduce epoxy coating as a method of mitigating the corrosion of reinforcing steel, let alone discuss the different methods used for coating the reinforcement. As a result, several myths have developed over the decades regarding the differences between the two products. In this article, I hope to clarify these differences and dispel any myths.

The first recorded use of ECR was in the Interstate 476 bridge over the Schuylkill River in Conshohocken, Pa., in 1973. In 1981, the first product standard for ECR was approved as ASTM A775, *Standard Specification for Epoxy-Coated Steel Reinforcing Bars*; today, this product type is known as the “green” bar. Because the epoxy coating material often cracked during bar fabrication, a new process was developed by pipe coaters to apply the epoxy coating (which contained additional filler) after fabrication. As the chemistry of the powder evolved, the ASTM A934, *Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars*, was developed and approved in 1995 as a second standard for ECR (for the “purple” bar). Meanwhile, the original coating material was also improved to prevent cracking during fabrication. Now ASTM A775 material is coated as a straight bar (typically in 20- to 64-ft lengths) and is then fabricated (cut and bent) after coating, whereas ASTM A934 material is prefabricated and then coated. Pigmentation is used to differentiate between the two products.

So, let’s dispel some myths.

Different processes are used for coating ASTM A775 and ASTM A934 bars

False. The ASTM A775 and ASTM A934 standard specifications both require the following processes:

1. Blast cleaning, which removes mill scale and creates an anchor profile to increase surface area to enhance adhesion of the epoxy to the steel
2. Heating, which brings the steel to 375°F to 475°F so that the epoxy powder “melts/fuses” upon contact with the steel
3. Powder application, which applies the epoxy powder in a contained environment with dust collection and recycling of unadhered powder
4. Curing, which allows the epoxy powder (once it has contacted the hot steel in the powder application) to gel and begin to cross link
5. Cooling, which allows the epoxy coating to harden to the point that it will not be damaged when the reinforcing bar is handled appropriately

The only difference in processing is the method by which the material is conveyed as the coating is applied and the size of the equipment used. ASTM A934 uses a chain conveyor from which the fabricated material hangs (on hooks) as it travels through the coating processes. The larger the items

are that are being coated, the larger the equipment must be. ASTM A775 material is simply conveyed on rollers, regardless of the length of the material.

A934 material is “harder” than A775 material; therefore, A934 ECR is less susceptible to jobsite damage

False. To qualify as an epoxy powder to meet the respective standards, both powders undergo the same tests: chemical resistance, cathodic disbondment, salt spray resistance, chloride permeability, coating flexibility, relative bond strength in concrete, abrasion resistance, and impact. The two specifications have identical setup and acceptance criteria, with the exception of impact testing. ASTM A934 requires the test be performed with an impact of 40 in.-lb, whereas ASTM A775 requires an impact of 80 in.-lb. Therefore, ASTM A775 ECR is designed to withstand harder impacts.

Testing of the products is the same

True (partially). Almost all of the same tests are run, but the acceptance criteria are different (**Table 1**). The epoxy powders are qualified separately from the finished product after coating. Therefore, the epoxy powders undergo the same testing as previously described; however, some of the finished product

Craney Island Fuel Depot, Portsmouth, Va. Photo: Lane Enterprises.



Table 1. Comparison of ASTM A934 and ASTM A775 epoxy-coated reinforcing steel acceptance criteria

| Attribute | ASTM acceptance criteria | |
|---------------------------------|---|---|
| | A934, <i>Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars</i> | A775, <i>Standard Specification for Epoxy-Coated Steel Reinforcing Bars</i> |
| Anchor profile | 1.5 to 4 mil | 1.5 to 4 mil |
| Flexibility | No. 3 to 5: 9-degree bend in 5 seconds No. 6 to 18: 6-degree bend in 5 seconds | 180-degree bend in 15 seconds |
| Continuity (holiday*) | Sampling offline—Random bars are selected for the testing, which is conducted by hand after the process is completed. | 100% online—Every bar goes through the testing while traveling down the line before it is discharged from the coating line. |
| Coating thickness | No. 3 to 11: 7 to 12 mil (up to 16 mil permitted in bend sections) | No. 3 to 5: 7 to 12 mil No. 6 to 18: 7 to 16 mil |
| Adhesion (cathodic disbondment) | Less than 0.25 in. | No test required |

*A holiday is a small, pinhole-size discontinuity in the coating that is not discernible to a person with normal, corrected vision.

testing varies slightly between the A934 (purple) and A775 (green) ECRs. For example, the finished purple bars must have a cathodic disbondment test performed, whereas the finished green bars do not require the test.

A934 powder can only be applied on custom lines

False. The confusion here is probably because fabricated bars (that are bent) cannot be coated on a straight bar line. They can only be coated on a custom line. Straight bars, however, can be coated on either type of line. Both custom and straight lines can produce A934 and A775 material. The challenge is meeting the testing requirements.

When A934 material is used in straight line production, the accelerated cathodic disbondment tests will need to be performed unless these tests are waived. When A775 material is used in custom lines, 100% holiday testing is required and the additional 4 mil of thickness on the bent sections will not be permitted.

A934 has better corrosion protection than A775

False. Both types provide the same level of protection. Epoxy is epoxy. Both

Epoxy-coated steel reinforcement conforming to ASTM A934 must be cut and fabricated before coating. It should not be bent or cut at the jobsite. It is necessary for ironworkers, detailers, and engineers to understand that “purple bars must be placed perfectly” because they cannot be modified.
Photo: Lane Enterprises.



materials provide an equivalent barrier to prevent corrosion of the steel.

Conclusion

When specifying the use of ASTM A934 material, the physical constraints of the coater need to be taken into consideration in the design and detailing of the project. Custom coaters will be restricted by the conveyance and size of their equipment. Epoxy Interest Group members only have five custom coating lines in North America: one each in Nevada, Ohio, and Pennsylvania, and two in Illinois.


Additionally, the current edition of ASTM A934 does not specify any product performance requirements for patching material; therefore, when specifying A934 for use, it is recommended to add to the specification that patching material shall meet the requirements of ASTM A775 Annex A2 (Requirements for Patching Material Used to Repair Organic Coatings for Steel Reinforcing Bars), which should prevent substandard materials from being used.

So, why the different colors? The colors were established primarily so that inspectors would know what criteria

to use when performing testing. Over time, the greatest benefactor of the different colors is the jobsite personnel. ASTM A934 material is not intended for projects where jobsite fabrication or modification may be required. Therefore, it is necessary for ironworkers, detailers, and engineers to understand that “purple bars must be placed perfectly” because they cannot be bent or cut later.

In the end, “Does color make a difference?” When it comes to highly effective, low-cost corrosion resistance, no, it doesn’t. Epoxy is colorblind.

References

1. ASTM International. 2019. *Standard Specification for Epoxy-Coated Steel Reinforcing Bars*. ASTM A775/A775M-19. West Conshohocken, PA: ASTM International.
2. ASTM International. 2019. *Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars*. ASTM A934/A934M-19. West Conshohocken, PA: ASTM International. 

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The only differences in processing ASTM A934 and ASTM A775 material are the method by which the material is conveyed as the coating is applied and the size of the equipment used. ASTM A934 material uses a chain conveyor from which the fabricated material hangs (on hooks) as it travels through the coating processes. Photo: Simcote Inc.

