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Metals Trivia:

- The metal that is the best conductor of electricity? Silver.
- In days gone by (when there actually were such machines), the phonograph stylus was often made of Osmium. The densest natural element.
- Rhenium was the last stable element to be discovered. In 1925.
- Vanadium was named for Vanadis (Freyja), the Norse Goddess of Beauty.

Have a Metals problem?
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Crack or defect inspection techniques that do not damage the product being tested may take many forms. Often potential defects are so small as to be nearly undetectable. Penetrant inspection is a popular detection method because it is relatively inexpensive, can be done remotely, and can be administered on a surface that is oriented in nearly any direction.

Penetrant Inspection may take the form of Fluorescent Penetrant Inspection (FPI) or visible Liquid Penetrant Inspection (LPI). Each has its advantages, so the selected method will be based on an internal or customer specification, or the type of part being examined. For example, FPI is often used on aircraft parts, while LPI is frequently used on machined surfaces, although neither alloy type nor product size limits which method is used.

In the early 1900s the railroad industry pioneered the oil and whiting penetrant inspection method using an oil solvent (the penetrant) and whiting or chalk coating (the developer) to detect imperfections. By the 1940s, fluorescent or visible dye was added and processes that included things like a defined soak/dwell time to generate uniform results were formalized.

Penetrant Inspection

Rules and specifications governing materials, process, training and certification of personnel have evolved over time. An essential element of that has been the development of specifications that define what acceptance limits are. That is, what differentiates between indications that are revealed during penetrant inspection that are critical, and which are not relevant? The customer will define and dictate that in the spec.



A limitation of penetrant inspection is that the defect or discontinuity must be open to the surface. Penetrant materials range in sensitivity and are developed and chosen to match the nature of the part surface and desired detectability of flaws. Highest sensitivity levels for demanding applications are used in a way that balances part manufacturability with engineering or performance needs.

Industry standards dictate how the process is managed to generate repeatable consistent results. In general: The penetrant method and sensitivity level are determined. The part is cleaned with specified cleaners and allowed to evaporate dry. Penetrant is sprayed or brushed on and allowed to dwell for a specified amount of time. After rinsing, the part is again dried, perhaps with a lint free paper towel, or may be oven dried. A white developer is then sprayed on the part, which acts like a blotter to draw penetrant from the discontinuity and appear as a contrasting color. After a specified dwell time, the part is inspected using a black light for FPI or other appropriate lighting for LPI. Any indications found are measured to determine if they constitute a rejectable defect.

As a reliable non-destructive means to discern potential defects in metal components, the various penetrant inspection methods are widely used. Appropriate process controls are needed to ensure the reliability of the tests, and highly trained inspectors are a key part of that.