

How to identify VD and Non-VD steels: A comprehensive approach

Steelmet Industries - Bright Bars, Alloy Steels, Free Cutting Steels, Stainless Steels

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Identifying whether a steel piece has gone through the Vacuum Degassing (VD) process is crucial for ensuring it meets the necessary quality standards. While there are several techniques to analyze and identify VD and non-VD steels, no single method can conclusively confirm the steelâ??s production route on its own. To make a reliable determination, you need to use a combination of processes. In this article, weâ??ll walk you through the most effective techniques and how they work together to establish whether a steel piece is VD route or not.

The Need for Multiple Techniques

Since VD steels are distinguished by their purity, reduced gas content, and improved mechanical properties, relying on just one technique may not provide a complete picture. Different methods reveal different aspects of the steelâ??s characteristics, and only by combining these insights can you accurately determine whether the steel has been vacuum degassed.

1. Chemical Analysis

Chemical analysis involves measuring the levels of dissolved gases like hydrogen, nitrogen, and oxygen in steel. VD steels typically have lower levels of these gases. Techniques such as Optical Emission Spectroscopy (OES) or Gas Chromatography are used for this analysis. However, this method alone isnâ??t definitive since environmental factors can affect gas levels.

Textual Reference:

- â??Vacuum Degassing Processâ?• by Steel Plant Technology, which provides a detailed overview of how vacuum degassing affects gas content in steel.

2. Microscopic Examination

Microscopic examination, using optical or electron microscopy, helps in assessing the cleanliness and inclusions in steel. VD steels generally have fewer non-metallic inclusions. This examination reveals the

internal cleanliness but should be used in conjunction with other methods, as inclusion levels can vary based on other processing factors.

Textual Reference:

- â??Metallographic Techniques for Steel Analysis,â?• ASM International, which covers the use of microscopy in analyzing steel properties and cleanliness.

3. Ultrasonic Testing

Ultrasonic testing detects internal defects and assesses uniformity. VD steels often exhibit fewer internal voids or gas pockets. This method is valuable but does not conclusively identify VD processing on its own, as good ultrasonic results can also be achieved with non-VD steels.

Textual Reference:

- â??Ultrasonic Testing Basics,â?• NDT.net, which provides an overview of how ultrasonic testing is used to assess steel quality.

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4. Hydrogen Content Measurement

Measuring hydrogen content is crucial as VD processing aims to reduce hydrogen levels. The hot extraction method measures hydrogen released from the steel when heated. While this provides strong evidence of VD processing, it should be verified with additional tests due to potential influences from other factors.

Textual Reference:

- â??Measurement of Hydrogen in Steel,â?• ScienceDirect, which explains the techniques used for measuring hydrogen content in steel.

5. X-Ray Diffraction (XRD)

X-Ray Diffraction (XRD) provides insights into the crystalline structure of the steel. VD steels typically show more defined peaks due to their homogeneity. Although XRD is not a direct identification method, it supports other findings regarding the steelâ??s structure.

Textual Reference:

- â??Introduction to X-Ray Diffraction,â?• Chemistry Views, which describes how XRD is used to analyze steelâ??s crystalline structure.

6. Spectroscopic Methods

Spectroscopic techniques like Fourier-transform infrared spectroscopy (FTIR) or Raman spectroscopy detect differences in chemical bonds and composition, indirectly indicating VD processing. These methods are more supportive and confirmatory rather than standalone.

Textual Reference:

- â??Applications of FTIR Spectroscopy,â?• ScienceDirect, which discusses how FTIR can be used to analyze steel and confirm processing methods.

7. Mechanical Testing

Mechanical tests such as tensile and impact tests can show properties typical of VD steels, like higher strength and toughness. While useful, these tests should be complemented with other methods since similar mechanical properties can be achieved through other processing techniques.

Textual Reference:

- â??Mechanical Testing of Steel,â?• Materials Unschool, providing insights into how mechanical testing is used to evaluate steel properties.

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8. Supplier Documentation and Certifications

Supplier documentation often includes certifications detailing the production process, including whether VD was used. While this information is useful, it should be cross-verified with physical tests to ensure accuracy.

Textual Reference:

- â??Understanding Steel Certifications,â?• CSA Group, which explains how certifications and documentation are used to confirm steel production processes.

A Combined Approach for Conclusive Identification

To conclusively identify VD route steel, itâ??s essential to use a combination of the above techniques. Hereâ??s how you can approach it:

1. **Start with Chemical Analysis:** Measure the levels of hydrogen, nitrogen, and oxygen to get an initial indication of whether VD was used.
2. **Use Microscopic Examination:** Check for non-metallic inclusions to assess the steelâ??s cleanliness, supporting the chemical analysis findings.
3. **Perform Ultrasonic Testing:** Look for internal defects to ensure the steelâ??s homogeneity, which is typical of VD route steel.
4. **Measure Hydrogen Content:** Specifically confirm the low hydrogen levels that are a hallmark of VD processing.
5. **Supplement with XRD and Spectroscopic Methods:** Use these techniques to provide additional evidence of the steelâ??s structural integrity and chemical composition.
6. **Conduct Mechanical Testing:** Verify the steelâ??s mechanical properties, ensuring they align with the expected performance of VD route steel.
7. **Review Supplier Documentation:** Cross-check physical test results with the documentation provided by the supplier to confirm the steelâ??s production process.

Conclusion

Identifying VD and non-VD steels is a complex process that requires more than just one technique. By combining chemical analysis, microscopic examination, ultrasonic testing, hydrogen content measurement, and other methods, you can reliably determine whether a steel piece has undergone the VD process. This comprehensive approach ensures that you select the right material for your application, meeting both quality standards and performance requirements.

For more detailed guidance and expert assistance in selecting the right steel for your needs, visit Steelmet Industries.

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