

# Establishing a reference standard for Type 304 Stainless Steel using the Tensile Test and Vickers Test

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## Abstract

Stainless steels are widely applied in the nuclear industry. This material is frequently metallographically examined to improve manufacturing and design practices. To better determine microstructural and hardness relationships to percent strain (% strain), a test program was completed to quantify this relationship. This test effort was completed to create a reference standard relating % strain for type 304 stainless to specific hardness and microstructural properties.

By establishing a reference standard, it will allow for predictions and recommendations on where potential risks for failure can occur or analyze and diagnose more efficiently why failures have occurred within this stainless steel type. Specifically, this report examines the results of on type 304 stainless steel. Establishing a reference standard for Type 304 Stainless Steel used the following test measures and applications to complete the examination: Tensile Testing, Metallography, Vickers Microhardness Testing.

## Introduction

Type 304 stainless is being tested for the creation of a reference standard relating % strain to microhardness and microstructure. Tensile testing to a unique % strain, microhardness and metallography will be completed for six (6) specimens and one (1) control specimen that was not strained. All specimens were machined from the same type 304 stainless steel plate and tested per the requirements of ASTM E 8 [Ref. 1]. From this data collection, future testing of materials will have baseline comparison to an established reference point.



Pre-test specimens using EDM<sup>1</sup>

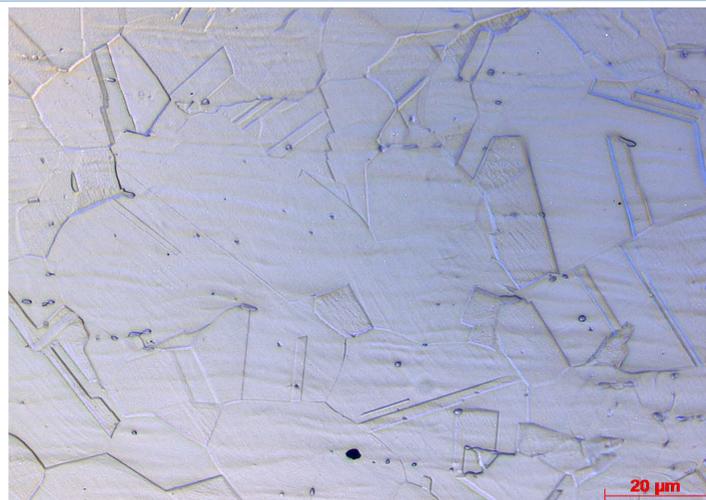
<sup>1</sup>Electrical discharge machine



Post-test Specimen #5 metallography



Post-test Specimen #1 metallography



Micrograph of Tested Specimen 1E Cross Section (Type 304 Etched), Non Strain

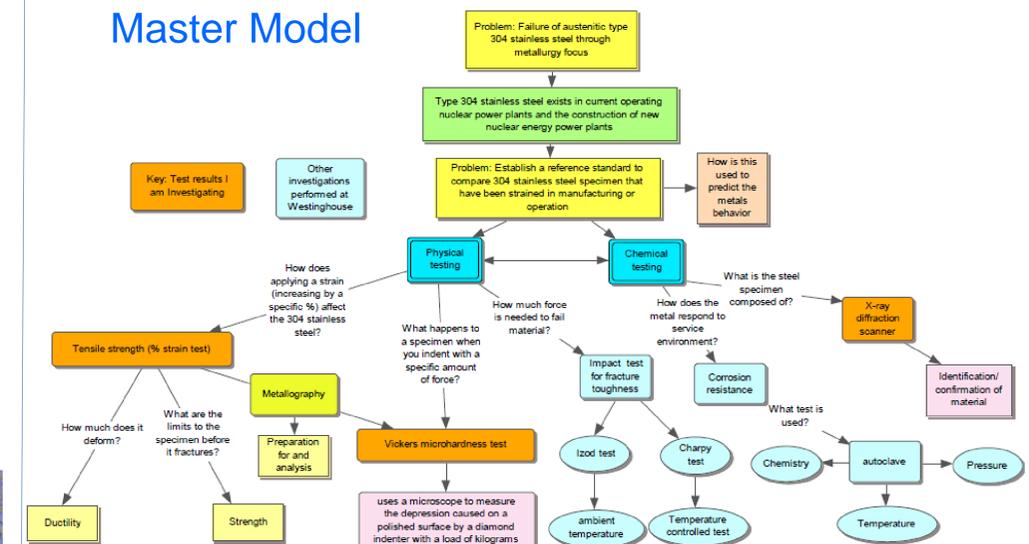


Micrograph of Tested Specimen 5 Cross Section (Type 304 Etched), 45.08% Strain

## Tensile Test Results

Specimen	Actual % Strain	Greatest Stress Reached (ksi)	% Elongation	% Reduction Area
1	5.03	57	4.45	6.14
2	10.03	65	9.65	8.27
3	17.02	77	17.25	15.44
4	30.04	87	30.40	24.67
5	45.08	93	46.70	32.80
6	40.04	91	42.05	30.50

## Master Model



## Conclusion

The creation of this reference standard for type 304 stainless steel can be used as template for establishing further types of steel commonly used in the nuclear industry. By connecting quantifying numerical data for this steel, the analysis of metal that has failed from the field will be more efficiently diagnosed. Overall, the testing did prove that as you increase strain on the metal, the harder the steel becomes.