Dataset Associated with:

Influence of Post-Weld Heat Treatments on the Hydrogen Embrittlement Susceptibility of API 5L X52N Pipeline Steel Welded Joints

This dataset contains the experimental data used to support the results and conclusions presented in the associated manuscript. The files include heat-treatment temperature records, hardness measurements, raw slow strain rate test (SSRT) data, and processed mechanical property data.

Dataset Contents

1. Table S1.xlsx

Temperature profile recorded during heat treatment HT1 (stress-relief heat treatment at 635.1 °C).

Sheet Format

Column	Description	Unit
Date	Recorded date	yyyy-mm-dd
Time	Recorded time	hh:mm:ss
Temperature	Furnace temperature	°C

Important Note

The absolute date and time values stored by the recording system are incorrect.

However, the elapsed time between measurements was recorded correctly. Consequently, the thermal cycle can be accurately reconstructed by taking the first measurement as:

t = 0 s

and calculating elapsed time relative to this first recorded point.

---

2. Table S2.xlsx

Temperature profile recorded during heat treatment HT2 (normalizing heat treatment at 911.4 °C).

Sheet Format

Column	Description	Unit
Date	Recorded date	yyyy-mm-dd
Time	Recorded time	hh:mm:ss
Temperature	Furnace temperature	°C

Important Note

As described for HT1, the absolute date and time values are incorrect, but elapsed time between measurements is accurate and should be used for thermal cycle reconstruction.

---

3. Table S3.xlsx

Temperature profile recorded during heat treatment HT3 (stress-relief heat treatment at 593.5 °C).

Sheet Format

Column	Description	Unit
Date	Recorded date	yyyy-mm-dd
Time	Recorded time	hh:mm:ss
Temperature	Furnace temperature	°C

Important Note

The same considerations described for HT1 and HT2 apply.

---

4. Table S4.xlsx

Vickers hardness (HV10) measurements performed across the weld cross-section.

The measurement locations correspond to those shown in **Figure 7** of the manuscript.

Measurements were carried out in two regions:

- **R1**
- **R2**

for each condition:

- AW (As welded)
- HT1
- HT2
- HT3

File Format

Column	Description
Line	Measurement line (R1 or R2)
1–19	Individual hardness measurement points
HV10	Vickers hardness value

Units

- Hardness: HV10

Notes

The measurement points numbered 1–19 correspond directly to the hardness traverse positions illustrated in Figure 7 of the manuscript.

---

5. Table S5.xlsx

Raw slow strain rate testing (SSRT) data for all tested specimens.

Each worksheet corresponds to a single SSRT specimen.

Sheet Naming Convention

Sheet names indicate:

Environment

- **Air** = inert environment
- **H2** = hydrogen environment (160 bar H_2)

Condition

- **SinTT** = As-welded (AW)
- **TT1** = HT1
- **TT2** = HT2

- **TT3** = HT3
- **BM** = Base metal reference

Sheet Format

Column	Description	Unit
Force	Applied load	N
Displacement	Total displacement	mm
Plastic Displacement	Plastic component of displacement	mm
Stress	Engineering stress	MPa
Strain	Engineering strain	%
Plastic Strain	Plastic strain	%
Time	Test duration	h

Notes

The data correspond to the complete SSRT acquisition recorded during testing and were used to generate stress-strain curves and determine mechanical properties reported in the manuscript.

---

6. Table S6.xlsx

Processed mechanical-property results for the as-welded condition (AW).

---

7. Table S7.xlsx

Processed mechanical-property results for heat treatment HT1.

---

8. Table S8.xlsx

Processed mechanical-property results for heat treatment HT2.

---

9. Table S9.xlsx

Processed mechanical-property results for heat treatment HT3.

---

10. Table S10.xlsx

Processed mechanical-property results for the homogeneous base metal (BM) reference condition.

Summary File Structure

Each processed-data file contains the results of individual specimens together with average values for inert and hydrogen environments.

Columns

Column	Description	Unit
Specimen ID	Specimen identifier	-
Environment	Test environment (inert or hydrogen)	-
Di	Initial specimen diameter	mm
Ai	Initial cross-sectional area	mm^2
E	Total displacement at failure	mm
Strain	Total engineering strain at failure	%
Dfmax	Maximum neck diameter after fracture	mm
Dfmin	Minimum neck diameter after fracture	mm
Df	Average final neck diameter	mm
RA	Reduction of area	%
YS	Yield strength	MPa
Max Load	Maximum applied load	N
UTS	Ultimate tensile strength	MPa
Ep	Plastic displacement at failure	mm

Column	Description	Unit
Plastic Strain	Plastic strain at failure	%
TTF	Time to failure	h
E_uts	Displacement at maximum load	mm
Ep_uts	Plastic displacement at maximum load	mm
Strain at UTS	Engineering strain at maximum load	%
Plastic Strain at UTS	Plastic strain at maximum load	%

Additional Entries

At the end of each summary file the following aggregate values are provided:

- Average Inert
- Average Hydrogen
- Ratios

The ratio values correspond to the hydrogen-to-inert performance metrics used for assessing hydrogen embrittlement susceptibility.

Experimental Conditions

Material

API 5L X52N pipeline steel girth weld.

Conditions Investigated

- AW: As-welded
- HT1: Stress-relief heat treatment (635.1 °C)
- HT2: Normalizing heat treatment (911.4 °C)
- HT3: Stress-relief heat treatment (593.5 °C)
- BM = Base metal reference

SSRT Environments

- Inert atmosphere
- High-pressure hydrogen (160 bar H_2)

11. Figure S1.pdf

Supplemental optical micrographs demonstrating the spatial resolution of the HV10 indentation relative to the HAZ sub-regions (for the HT1 condition).

The file contains the following images:

- Indentation at a CGHAZ measurement position (closest to the fusion line)
- Indentation at an intermediate HAZ measurement position
- Indentation at a FGHAZ measurement position (furthest from the fusion line)
- Low-magnification overview showing all indentation locations across the HAZ

These images confirm that the indentation footprint (~275 µm) remains entirely within a single HAZ sub-region at each measurement location.

Contact

For questions regarding the dataset or data interpretation, please contact the corresponding author listed in the manuscript.
