Castilla-La Mancha

Empresa beneficiaria de las subvenciones de la Junta de Comunidades de Castilla-La Mancha: Ayudas –Adelante Digitalización- para la transformación digital de las pymes de Castilla-La Mancha.

Proyecto incentivado con una subvención cofinanciada por el Fondo Europeo de Desarrollo Regional.

Objetivo del proyecto: La modernización de las estrategias de comunicación y venta, y para el impulso a la actividad de comercio electrónico de las pymes.

Cofinanciado por
la Unión Europea

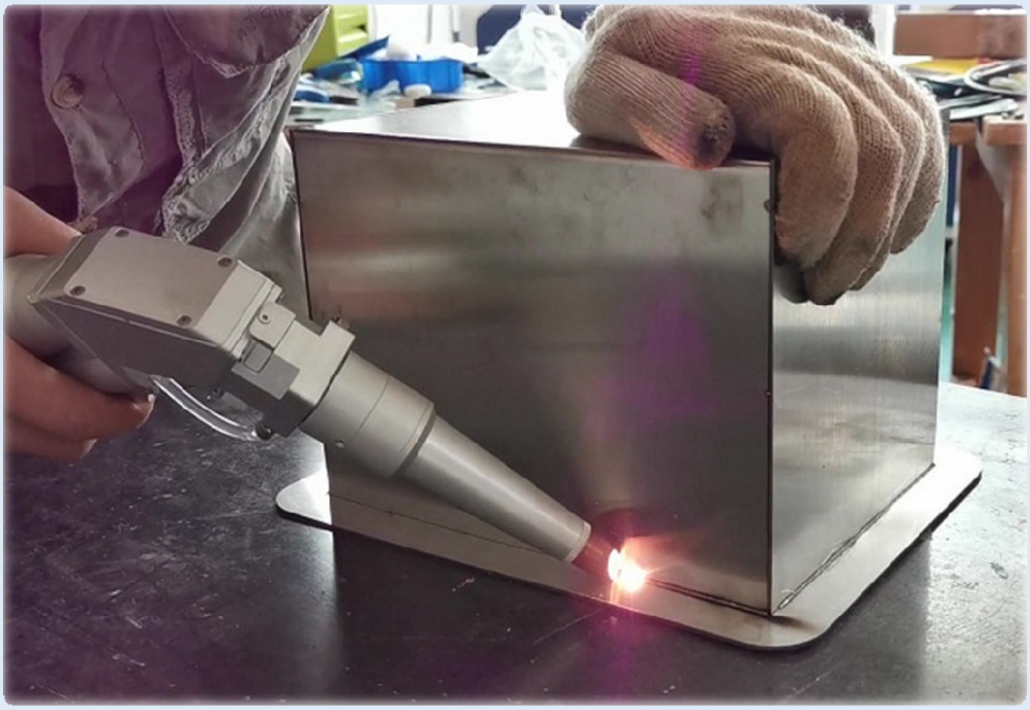
RELACIÓN DE ALGUNOS PROYECTOS REALIZADOS CON MAQUINARIA DE ALTA TECNOLOGÍA PARA MEJORA DE PRODUCTIVIDAD, CALIDAD Y USO DE TECNOLOGÍAS LIMPIAS PARA EL MEDIOAMBIENTE

Nº EXPEDIENTE: 4519FIE374
TITULAR: SOLUCIONES INDUSTRIALES Y SOLDADURA 2008, S.L.
NIF: B45670015

A continuación se relacionan algunos proyectos realizados con las máquinas adquiridas en agosto de 2021, hasta la actualidad, que han ayudado en la continuidad de nuestra empresa.

ALGUNOS TRABAJOS REALIZADOS CON EQUIPO N. 1-   Número de Serie: CY2021FW0930192

– *SOLDADURA CON LASER FIBRA* – POTENCIA: 1500 W



1. **Soldadura de componentes de varias aleaciones: UNIVERSIDAD PONTIFICIA COMILLAS – Septiembre 2021**

2. Soldadura de alas de cohete para **STAR-U3CM** – Abril 2022 y Septiembre 2022
Enlace al proyecto: https://de.linkedin.com/posts/star-uc3m_solysol-es-una-empresa-de-asesoramiento-activity-6917392562110484480-0Sb-

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3. **Soldadura de bandejas para aplicación alimentaria:**
   - **3.1. MEIFUS – Junio 2022**
   - **3.2. CALDEMECA – Octubre 2022**

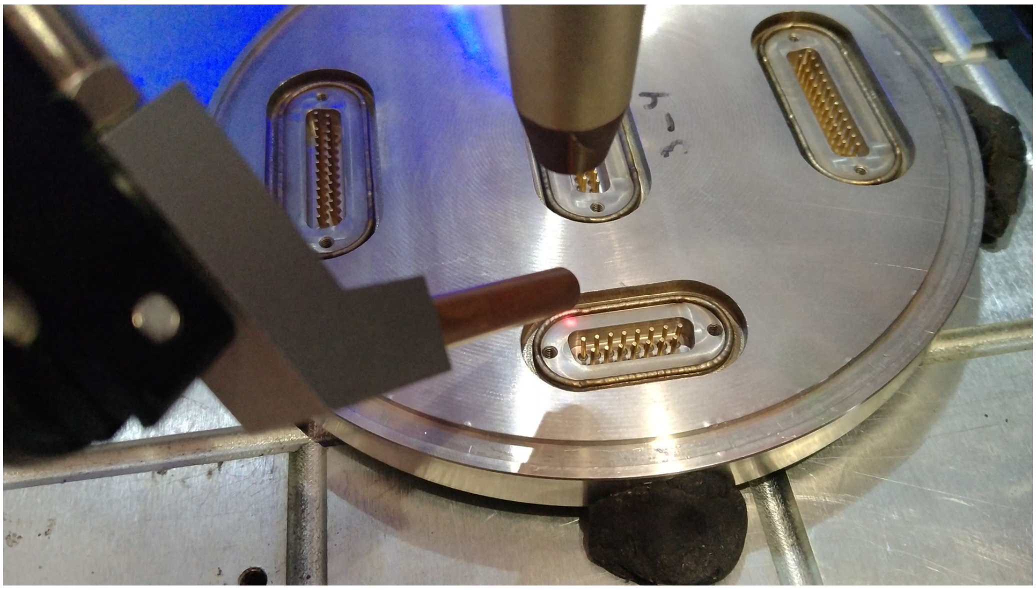
4. Soldadura de componentes de acondicionamiento: AIRFLOW – Mayo 2022

ALGUNOS TRABAJOS REALIZADOS CON EQUIPO N. 2 - Número de Serie: CY2019MJH1031103

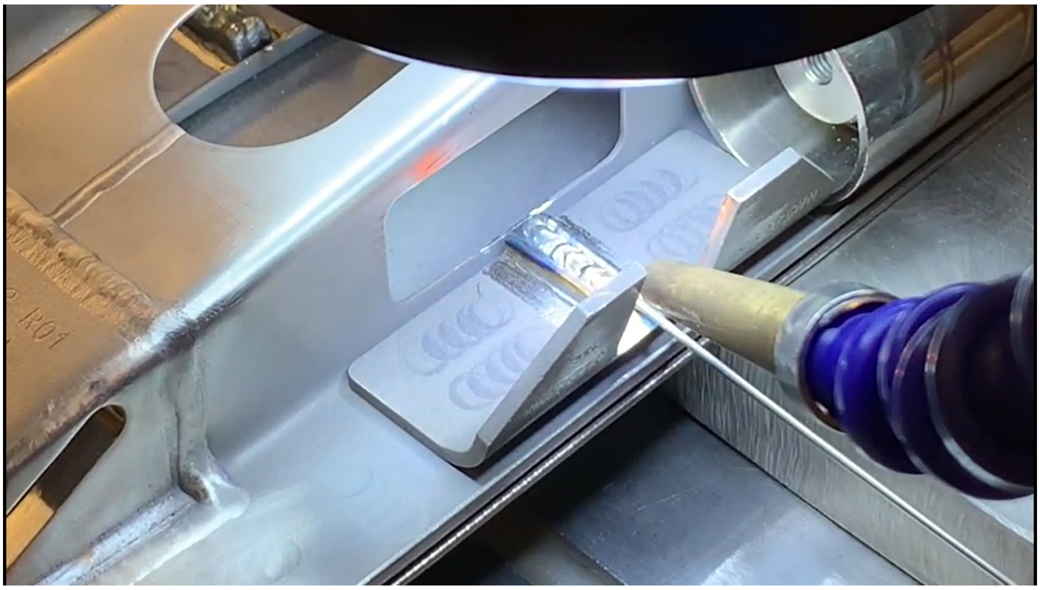
– *SOLDADURA MICROLÁSER – YAG PULSADO* – POTENCIA: 500 W

1. **Soldadura de tubos de intercambiador químico – PROYSER – Octubre 2021**

2. **Pruebas para la soldadura de conectores de aleaciones exóticas para el INSTITUTO ASTROFÍSICO DE CANARIAS: - Junio 2022**



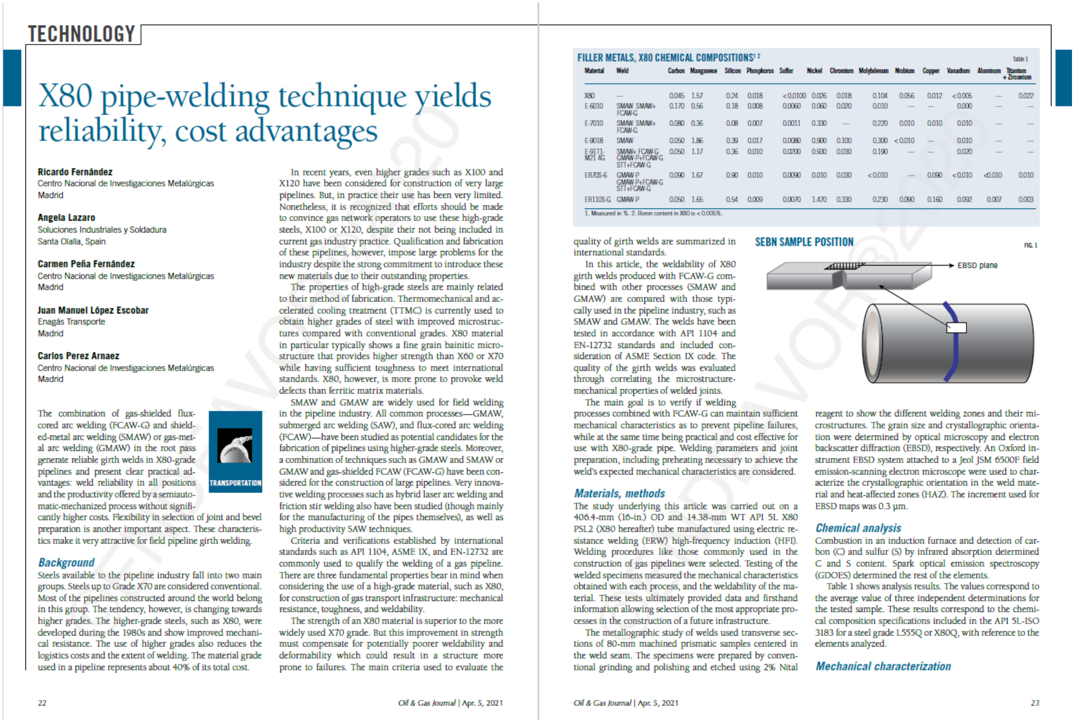
3. **Soldaduras sobre aleaciones ligeras para industria aeronáutica – ITP – Septiembre 2022:**



ALGUNOS TRABAJOS REALIZADOS CON EQUIPO N. 3 - Número de Serie: IND210930/2

– *CALENTAMIENTO POR INDUCCIÓN – INVERTER* – POTENCIA: 40 KW

1. **Investigación Comportamiento Procesos de Soldadura para Tubo de Conducción de Hidrógeno – ENAGAS – Febrero a Octubre 2021**
   Paper en Revista Técnica Internacional OIL&GAS:



TECHNOLOGY

X80 pipe-welding technique yields reliability, cost advantages

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The combination of gas-shielded flux-cored arc welding (FCAW-G) and shielded-metal arc welding (SMAW) or gas-metal arc welding (GMAW) in the root pass generate reliable girth welds in X80-grade pipelines and present clear practical advantages: weld reliability in all positions and the productivity offered by a semiautomatic-mechanized process without significantly higher costs. Flexibility in selection of joint and bevel preparation is another important aspect. These characteristics make it very attractive for field pipeline girth welding.

TRANSPORTATION

Background

Steels available to the pipeline industry fall into two main groups. Steels up to Grade X70 are considered conventional. Most of the pipelines constructed around the world belong in this group. The tendency, however, is changing towards higher grades. The higher-grade steels, such as X80, were developed during the 1980s and show improved mechanical resistance. The use of higher grades also reduces the logistics costs and the extent of welding. The material grade used in a pipeline represents about 40% of its total cost.

In recent years, even higher grades such as X100 and X120 have been considered for construction of very large pipelines. But, in practice their use has been very limited. Nonetheless, it is recognized that efforts should be made to convince gas network operators to use these high-grade steels, X100 or X120, despite their not being included in current gas industry practice. Qualification and fabrication of these pipelines, however, impose large problems for the industry despite the strong commitment to introduce these new materials due to their outstanding properties.

The properties of high-grade steels are mainly related to their method of fabrication. Thermomechanical and accelerated cooling treatment (TTMC) is currently used to obtain higher grades of steel with improved microstructures compared with conventional grades. X80 material in particular typically shows a fine grain bainitic microstructure that provides higher strength than X60 or X70 while having sufficient toughness to meet international standards. X80, however, is more prone to provoke weld defects than ferritic matrix materials.

SMAW and GMAW are widely used for field welding in the pipeline industry. All common processes—GMAW, submerged arc welding (SAW), and flux-cored arc welding (FCAW)—have been studied as potential candidates for the fabrication of pipelines using higher-grade steels. Moreover, a combination of techniques such as GMAW and SMAW or GMAW and gas-shielded FCAW (FCAW-G) have been considered for the construction of large pipelines. Very innovative welding processes such as hybrid laser arc welding and friction stir welding also have been studied (though mainly for the manufacturing of the pipes themselves), as well as high productivity SAW techniques.

Criteria and verifications established by international standards such as API 1104, ASME IX, and EN-12732 are commonly used to qualify the welding of a gas pipeline. There are three fundamental properties bear in mind when considering the use of a high-grade material, such as X80, for construction of gas transport infrastructure: mechanical resistance, toughness, and weldability.

The strength of an X80 material is superior to the more widely used X70 grade. But this improvement in strength must compensate for potentially poorer weldability and deformability which could result in a structure more prone to failures. The main criteria used to evaluate the

FILLER METALS, X80 CHEMICAL COMPOSITIONS[1 2] Table 1

Material	Weld	Carbon	Manganese	Silicon	Phosphorus	Sulfur	Nickel	Chromium	Molybdenum	Niobium	Copper	Vanadium	Aluminum	Titanium + Zirconium
X80	—	0.045	1.57	0.24	0.018	<0.0100	0.026	0.018	0.104	0.056	0.012	<0.005	—	0.022
E-6010	SMAW SMAW+ FCAW-G	0.170	0.56	0.18	0.008	0.0060	0.060	0.020	0.010	—	—	0.000	—	—
E-7010	SMAW SMAW+ FCAW-G	0.080	0.36	0.08	0.007	0.0011	0.330	—	0.220	0.010	0.010	0.010	—	—
E-9018	SMAW	0.050	1.86	0.39	0.017	0.0080	0.900	0.100	0.300	<0.010	—	0.010	—	—
E-91T1-M21 4G	SMAW+ FCAW-G GMAW-P+FCAW-G STT+FCAW-G	0.050	1.17	0.36	0.010	0.0200	0.930	0.030	0.190	—	—	0.020	—	—
ER70S-6	GMAW-P GMAW-P+FCAW-G STT+FCAW-G	0.090	1.67	0.90	0.010	0.0090	0.010	0.030	<0.010	—	0.090	<0.010	<0.010	0.010
ER110S-G	GMAW-P	0.050	1.65	0.54	0.009	0.0070	1.470	0.330	0.230	0.090	0.160	0.092	0.007	0.003

1. Measured in %. 2. Boron content in X80 is <0.005%.

quality of girth welds are summarized in international standards.

In this article, the weldability of X80 girth welds produced with FCAW-G combined with other processes (SMAW and GMAW) are compared with those typically used in the pipeline industry, such as SMAW and GMAW. The welds have been tested in accordance with API 1104 and EN-12732 standards and included consideration of ASME Section IX code. The quality of the girth welds was evaluated through correlating the microstructure-mechanical properties of welded joints.

SEBN SAMPLE POSITION FIG. 1

EBSD plane

The main goal is to verify if welding processes combined with FCAW-G can maintain sufficient mechanical characteristics as to prevent pipeline failures, while at the same time being practical and cost effective for use with X80-grade pipe. Welding parameters and joint preparation, including preheating necessary to achieve the weld's expected mechanical characteristics are considered.

Materials, methods

The study underlying this article was carried out on a 406.4-mm (16-in.) OD and 14.38-mm WT API 5L X80 PSL2 (X80 hereafter) tube manufactured using electric resistance welding (ERW) high-frequency induction (HFI). Welding procedures like those commonly used in the construction of gas pipelines were selected. Testing of the welded specimens measured the mechanical characteristics obtained with each process, and the weldability of the material. These tests ultimately provided data and firsthand information allowing selection of the most appropriate processes in the construction of a future infrastructure.

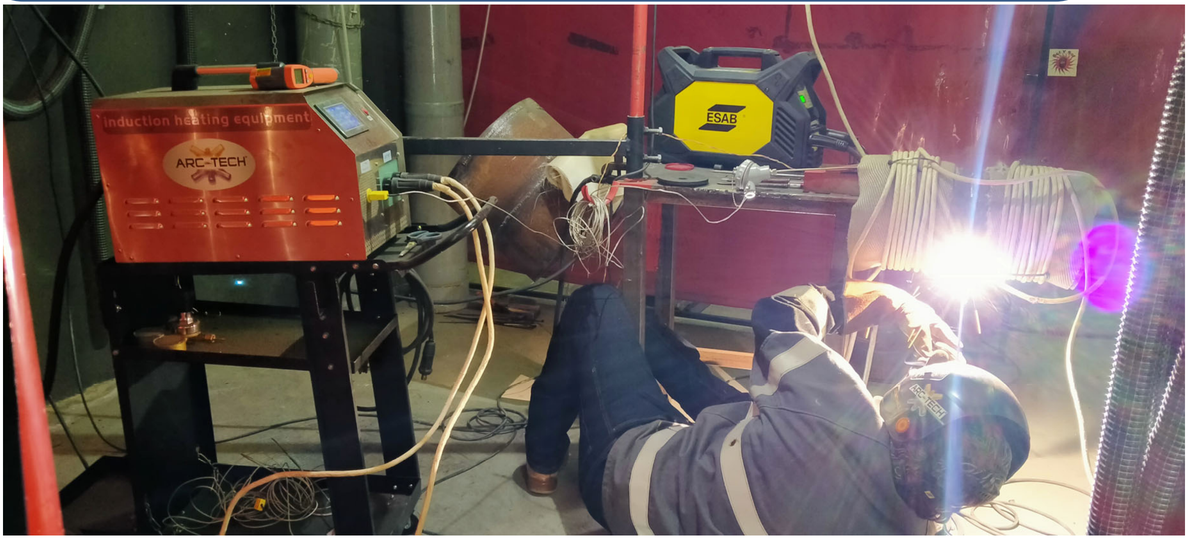
The metallographic study of welds used transverse sections of 80-mm machined prismatic samples centered in the weld seam. The specimens were prepared by conventional grinding and polishing and etched using 2% Nital reagent to show the different welding zones and their microstructures. The grain size and crystallographic orientation were determined by optical microscopy and electron backscatter diffraction (EBSD), respectively. An Oxford instrument EBSD system attached to a Jeol JSM 6500F field emission-scanning electron microscope were used to characterize the crystallographic orientation in the weld material and heat-affected zones (HAZ). The increment used for EBSD maps was 0.3 μm.

Chemical analysis

Combustion in an induction furnace and detection of carbon (C) and sulfur (S) by infrared absorption determined C and S content. Spark optical emission spectroscopy (GDOES) determined the rest of the elements.

Table 1 shows analysis results. The values correspond to the average value of three independent determinations for the tested sample. These results correspond to the chemical composition specifications included in the API 5L-ISO 3183 for a steel grade L555Q or X80Q, with reference to the elements analyzed.

Mechanical characterization



2. **Soldadura de WAY-TEE de bifurcación de alimentación de gas natural Refinería Repsol Cartagena – Octubre 2021:**
   Enlace a información del proyecto: https://arctech.es/soldadura-way-tee-tubo-en-servicio/

3. Calentamiento de componentes pesados para soldadura – DUOMO – Septiembre-Octubre 2022:

4. Calentamiento componentes de gran espesor para fabricación puente – ACCIONA – Junio 2022:

ALGUNOS TRABAJOS REALIZADOS CON EQUIPO N. 4 - Número de Serie: IND210930/1

CALENTAMIENTO POR INDUCCIÓN – INDUSTRIA PESADA – POTENCIA: 80 KW

1. Reparación de torres eólicas en Polonia – EIFFAGE – Febrero 2022

2. **Calentamiento para soldadura de estructura metálica pesada – Nuevo Estadio Santiago Bernabéu – Septiembre 2021 – Junio 2022:**