Electron Beam Welding

acamp
ALBERTA CENTRE FOR ADVANCED MNT PRODUCTS

Introduction

Electron beam welding is a fusion welding process and can be used for welding a wide variety of metals, such as stainless steel, Inconel, copper and other variations of their grades. The metal thicknesses range from foils to thick metals sheets. In addition, two different metals or alloys can be welded together. E-beam welding has a vast variety of applications such as; electronics and packaging, automotive and aircraft industry, and in medical technology. In particular, down-hole tools for the oil and gas industry can be processed.

The electron beam welder at ACAMP's Calgary facility is the only one of its kind available for general use by any company.

Advantages of E-Beam Welding

- No extra material is added for the welding process
- With a proper parameter setup, it is possible to obtain a very smooth and seamless surface finish
- Physical and mechanical properties of electron beam welded samples are typically better than welds made using other processes, in particular for metals like Inconel which are difficult to machine
- The welding process operates under vacuum which helps flushing out oxides, nitrides and carbides
- Results in faster and cleaner welds
- Precise control of heat affected zones is achieved, which is extremely advantageous when welding samples with built-in temperature sensitive components

Capabilities

Welding Parameters

The electron beam welder at ACAMP can provide these operational parameters:

- *Beam current (0 – 83 mA)*
- *Accelerating voltage (0- 60 kV in steps of 10 kV)*
- *Weld timer (or number of welds specification)*
- *Spin speed (0.1 – 100 RPM)*
- *Programmable for repeated operations*

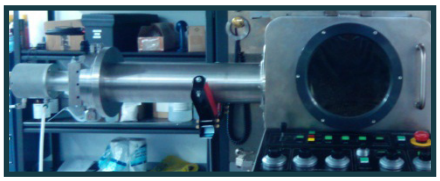
The user can select the best parameters within these ranges depending on the metal welded. This allows for targeting process properties such as weld width, weld depth, and surface finish. ACAMP periodically calibrates the system in order to maintain the consistency of the welding parameters.

Dismountable Add-on Welder Extensions

Custom extensions on the e-beam welder allow for a highly flexible process. Size ranges of parts we can machine:

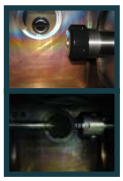
- Parts with diameters ranging from 0.5" to 1.25" gripped in the chuck/collet
- Up to 42" long parts, according to the location of the weld
- The body of the part can range up to a maximum 4" diameter and 8" length inside the welding chamber

Side door for mounting components of 4" diameter



Tailstock side extension

Chuck side extension



Replaceable collet/ 3-jaw chuck

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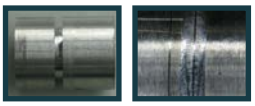
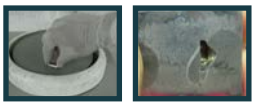
Weld Characterization

A complete in-house welding characterization setup is available to users who wish to characterize and optimize their welding parameters.



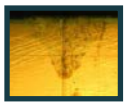
1. Welding

2. Dicing (bandsaw)

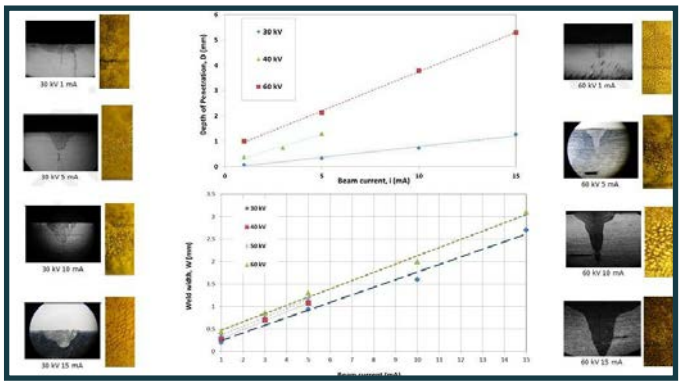


3. Surface polishing

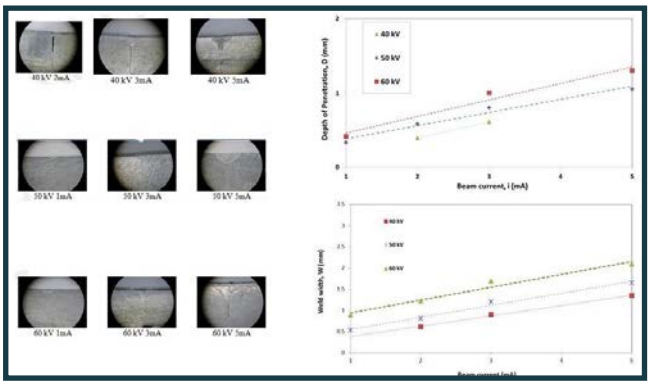
4. Etching (chemical / electrolytic)



5. Measurement



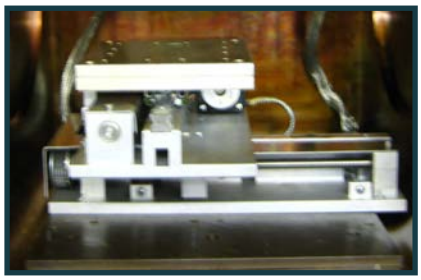
Characterization of stainless steel 316 weld parameters



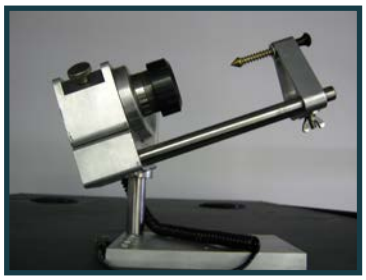
Characterization of Inconel 718 weld parameters

Different Welding Platforms

Other than circular welding, the e-beam welder at ACAMP is capable of housing an elliptical chuck and motion controlled x-y stage for oblique welding and in-plane welding, respectively. In addition, the CNC programming facility provides a wide range of weld geometries and complex contours for in-plane welding



X-Y stage for in-plane welding



Elliptical chuck

Welding complex contours

Equipment Rental

The e-beam welder can be rented out to users at an hourly rate. You can choose to be trained under the guidance of an expert ACAMP engineer and operate the system by yourself, or seek assistance of ACAMP's staff to perform the welding. The equipment is located at ACAMP Calgary.

Contact ACAMP Calgary

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