

A Simple Device for Characterizing High Power Electron Beams for Welding

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Abstract : Electron beam welding due to its inherent advantages is being extensively used for material processing where high precision is required. Especially in aerospace or nuclear industries, there are high quality requirements and the cost of materials and processes is very high which makes it very important to ensure the beam quality is maintained and checked prior to carrying out the welds. Although the processes in these industries are highly controlled, however, even the minor changes in the operating parameters of the electron gun can make large enough variations in the beam quality that can result in poor welding. To measure the beam quality a simple device has been designed that can be used at high powers. The device consists of two slits in x and y axis which collects a small portion of the beam current when the beam is deflected over the slits. The signals received from the device are processed in data acquisition hardware and the dedicated software developed for the device. The device has been used in controlled laboratory environments to analyse the signals and the weld quality relationships by varying the focus current. The results showed matching trends in the weld dimensions and the beam characteristics. Further experimental work is being carried out to determine the ability of the device and signal processing software to detect subtle changes in the beam quality and to relate these to the physical weld quality indicators.

Keywords : electron beam welding, beam quality, high power, weld quality indicators

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