Mechanical properties and characterization of TIG-welded filter elements used in oilfield sand control screens

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Over 80% of all oil produced in Brazil comes from sandstone reservoirs mostly requiring completions designed to prevent the production of solids. Sand Control Premium Screens provide in-situ filtration of the produced oil leaving the sand grains out of the rest of the well's completion [1]. In order to ensure suitable mechanical properties for such application, diffusion-bonded filter element samples with TIG seam welds [2], a crucial component of these screens, were produced and characterized. The welds in which metallic woven is one of the parts to be joined a critical issue arises regarding stability of the molten pool and welding arc. In order to develop a suitable welding procedure for this task, different arc welding processes were addressed. Figure 1 shows a mean tensile strength of 4.448 N and 21,65 % strain. One can observe that the failure occurred at the heat affected zone (HAZ) of the TIG seam weld for all tested samples. This zone is susceptible to failure due to stress concentrations arising from the transition between the solid seam weld and the porous filter. Microhardness measurements evaluated mechanical properties in the base diffusion-bonded filter, HAZ and fusion zones of the TIG seam weld, as seen in Table 1.



Figure 1: Mechanical properties in terms of tensile strength for AISI 316L diffusion bonded and TIG seam welded filter element with $250 \,\mu m$ pore opening media.

Table 1 – Wheromatchess measurements of samples.			
	Base material	Heat affected zone	Fusion zone
AISI 316L	$(308 \pm 28) \text{ HV}_{200g}$	$(239 \pm 30) \text{ HV}_{200g}$	$(163 \pm 3) \text{ HV}_{200g}$

Table 1 – Microhardness measurements of samples.

<u>Keywords:</u> Diffusion bonding, Filter element, Premium Sand Control Screen, Stainless steel, Mechanical Properties, Strength, Microhardness.

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