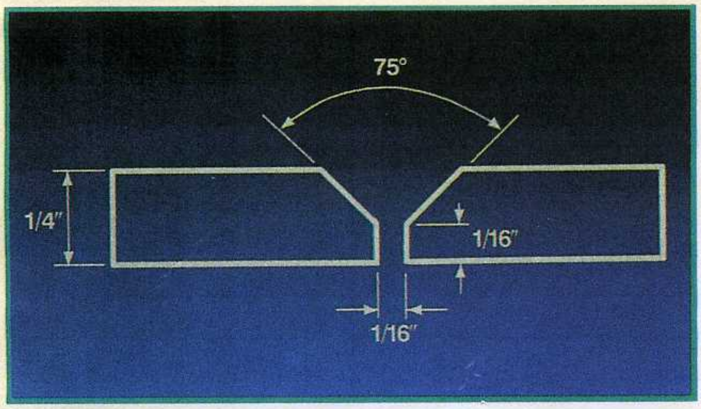

Fig. 2—Schematic of weld joint.

used in high-purity cleaning applications.

The gas manifold to the weld torch was purged for about 1 h at a flow rate of approximately 50 ft^3/h (23.6 L/min) to minimize contamination by atmospheric air or moisture absorbed on the interior walls of the gas delivery system. By closing the weld area, wind drafts such as those caused by opening or closing of doors were eliminated during this test.

Tacking and welding were performed using argon shielding and backing gas. Shielding and backing gas impurity levels and gas tungsten arc welding parameters are listed in Table 1.

The filler metal for each alloy was a matching composition. Ferralium 255 filler did not contain nickel enrichment. Autogenous welding was avoided. The filler metal was used throughout the weld joint with care taken to protect the molten weld pool by using both a postpurge as well as a prepurge to sweep out any air/moisture that may have filtered in during shut down. Care was taken to keep the melted end of the welding wire within the shielding gas envelope.

Weld starts and stops were accomplished with a foot-operated current control. A high-frequency start was used to avoid scratching the workpiece with the tungsten electrode. Power was supplied by a Miller Syncrowave 300-A machine.

During welding, it was observed that when using the new resin purifier, the surface of the molten weld pool was absolutely clean. Without purification, the surface of the molten weld pool contained particulates (oxides) moving wildly about.

Wetting appeared to be improved with purification. Improved wetting suggests a reduction in the viscosity and/or surface energy (surface tension) due to impurity removal from the weld pool.

Weld joints were completed in three to four weld passes from one side. Penetration was complete with the backside bead contour slightly convex.

Weld Evaluation

Upon completion, the welds were examined visually. The backsides of the welds were bright and shiny with no evidence of heat tint or oxidation. Each weld was radiographed and found to be free of any apparent internal weld defects. Because the two alloys tested are sensitive to interstitial contamination, the welds were evaluated with the Charpy V-notch impact test. In this particular test the specimens were one-quarter size. Test results are summarized in Figs. 3 and 4.

The Charpy V-notch data also included mils lateral expansion, the ability of the material to flow under dynamic loading conditions, and the percent shear fracture for each impact specimen at the various test temperatures. These properties behaved in the same manner as the impact energy absorbed, as shown in Figs. 3 and 4. Gas purification significantly improved the mils lateral expansion and percent ductile shear fracture.

In these tests, the levels of contamination in the shielding

Table 1—Welding Process Conditions

Material	E-Brite 26-1	Ferralium 255
Plate Size (in.)	¼ × 12 × 6	¼ × 12 × 6
Welding wire addition	yes	yes
Shielding gas	argon	argon
Impurity level, ppm		
H_2O	40	40
O_2	20	20
Flow rate, ft^3/h	60	60
Voltage	14	14
Current (A) (DCSP)	150	150
Travel speed (in./min)	3.5–6	3.5–6

Shielding gas flow rates reflect the use of a large ceramic nozzle with a ¾-in. ID and gas lens collet body.

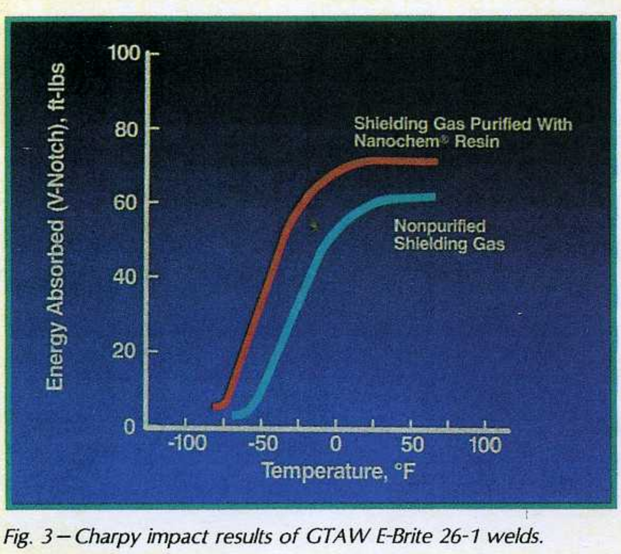

Fig. 3—Charpy impact results of GTAW E-Brite 26-1 welds.

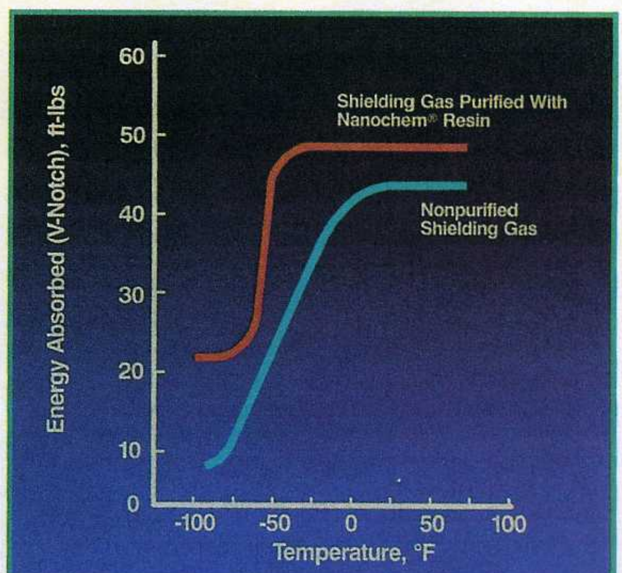

Fig. 4—Charpy impact results on GTAW Ferralium 255 welds.