



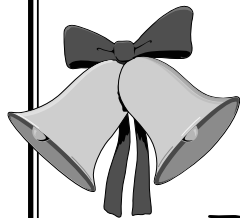
Update

Edition 5, Volume 2

Canadian Welding Association - Toronto Chapter

November 2002

Sponsored by the Ontario Chapter of the Canadian Institute for NDE



11th ANNUAL CINDE/CWA Christmas

Dinner & Dance

Saturday, December 7, 2002

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- Cocktails at 6:30 pm • Dinner at 7:30 pm
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Special All Day Seminar!

Monday, February 10, 2003

Topic:

**Designing Joints for Improved
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Presented by:

Duane Miller, Sc.D, P.E.

Register today! For information call 905-821-6916
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Pay it Forward

Recently, the University of Waterloo held its Engineering Awards Dinner showcasing all the students that have been awarded scholarships throughout the year. Scholarships are given by the University, foundations, private individuals, companies and associations like the CWA.

Chris Carr was this years CWA Mike Cherry Memorial Scholarship recipient. Chris received his \$2,500 scholarship at the CWA Awards Dinner in October. After his last year at Waterloo in mechanical engineering specializing in welding, Chris plans to pursue a Masters in engineering in the welding field. Good Luck Chris.

Over 370 students were given scholarships at Waterloo this year to help with the financial burden of tuition. An undergraduate engineering degree is approx. \$30,000 for the tuition only and 50% will graduate with a minimum personal debt of \$15,000.

"The days of coop programs providing enough money to pay for tuition are a thing of the past", noted Hugh Kerr, a semi-retired professor involved with Waterloo's welding program. The keynote speaker at the Awards Dinner, Mr. Vernon Lobo, Managing Director of Mosaic Venture Partners, reminded everyone of the importance to give a little back – whether it be to the poor, your old school, your family or friends. The CWA wants to thank all that supported the Mike Cherry Memorial Golf Tournament and because of you we were able to give a little back.

EDUCATIONAL INFO:

Basic Considerations when Welding Nickel Alloys

The thermal conductivity of nickel is higher than that of carbon and alloy steels (fig. 10) and this contributes to the greater difficulty of achieving good fusion between parent metal and added weld metal. To minimize potential fusion problems, joints should be designed with wide angles to provide space for the filler metal and allow good fusion of the base metal. Most of the major welding processes are suitable for welding nickel or nickel alloys. Both gas shielded and flux shielded arc welding processes are employed, and the relatively high electrical resistance (fig. 11) allows these materials to be welded by resistance welding methods. Some alloys, however, may require special processes. In particular the precipitation hardened alloys can generally only be satisfactorily welded with the GTAW process.

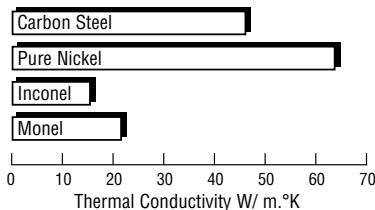


Figure 10. Thermal conductivity of some nickel alloys compared with that for steel.

Heat input is normally limited in welding nickel and its alloys in order to reduce the risk of hot cracking, minimize grain growth, and retain corrosion resistance. This may limit

ELECTRODE	NOMINAL COMPOSITION									
	C	MN	SI	FE	NI+CO	CR	CU	MO	TI	OTHER
ERNi-1	0.15	1.0	0.75	1.0	93.0#	-	0.25	-	2.0-3.5	1.5 Al
ERNiCu-7	0.15	4.0	1.25	2.5	62.0-69.0	-	rem	-	1.5-3.0	1.25 Al
ERNiFeCr-1	0.05	1.0	0.5	22.0#	38.0-46.0	19.5-23.5	1.5-3.0	2.5-3.5	0.6-1.2	0.2 Al
ERNiCrFe-6	0.08	2.3	0.1	6.6	71.0	16.4	0.04	-	3.2	
ERNiCr-3	0.10	2.5-3.5	0.5	3.0	67.0#	18.0-22.0	0.5	-	.75	2.0-3.0 Nb (Cb)
ERNiCrFe-5	0.08	0.10	0.35	6.0-10.0	70.0#	14.0-17.0	0.5	-	-	1.5-3.0 Nb (Cb)
ERNiMo-1	0.08	1.0	1.0	4.0-7.0	rem	1.0	0.5	26.0-30.0	-	-
ERNiCrMo-3	0.01	0.5	0.5	5.00	58.0#	20.0-23.0	0.5	8.0-10.0	0.4	3.15-4.15 Nb (Cb)
ERNiCrMo-4	0.02	1.0	0.5	22.0#	38.0-46.0	19.5-23.5	1.5-3.0	2.5-3.5	0.6-1.2	0.2 Al
ERNiCrMo-9	0.05	1.0	0.08	4.0-7.0	rem	14.5-16.5	0.5	15.0-17.0	-	3.0-4.5 W
ERNiFeCr-1	0.015	1.0	1.0	18.0-21.0	rem	21.0-23.5	1.5-2.5	6.0-8.0	-	1.5 W

min For details refer to AWS A5.14 "Specification for Nickel and Nickel Alloy Bare Welding Rods and Electrodes"

Table 6. Some examples of the composition of electrodes for welding nickel and nickel alloys. Note the use of titanium to control nitrogen and reduce porosity.

the processes suitable, many alloys being preferably welded with GTAW only. Heat input is also minimized by employing stringer bead techniques rather than wide weaving. When submerged arc welding is employed fluxes specially designed for nickel alloys must be used, those for carbon steel or stainless steel being unsuitable.

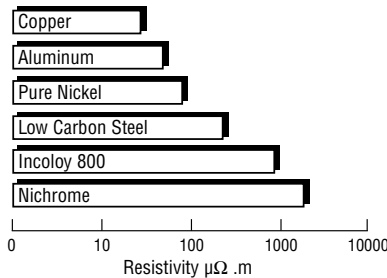


Figure 11. Electrical resistivity of some nickel alloys compared with other metals

Porosity

The drop in solubility of nitrogen in cooling liquid nickel is high and presents a significant risk of porosity if nitrogen is allowed to dissolve in the weld pool. Porosity due to nitrogen is one of the chief problems

in welding pure nickel and some of the nickel alloys, and special attention to details of the welding procedure that affect nitrogen pickup is required.

To alleviate the problems of nitrogen and to provide some deoxidizing capability, electrodes for nickel and nickel alloys contain titanium or other strong nitride and oxide formers (Table 6). This allows the shielded metal arc process to be used, but it is still necessary to employ a very short arc technique since a long arc will tend to encourage nitrogen pickup.

Gas Shielding

Gas shielding in the GTAW process is critical when joining nickel or its alloys. Reverse side shielding is necessary, and the correct gas cup size and torch angle is important to avoid air entrapment. If filler metal is added by hand the tip of the rod must always be held in the gas shield of the arc and not periodically.

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