

Liljeblad International Consulting AB

Established June 2006

With focus on

- **International Marketing**
- **International Sales**
- **International Business Development**

Industries & Applications

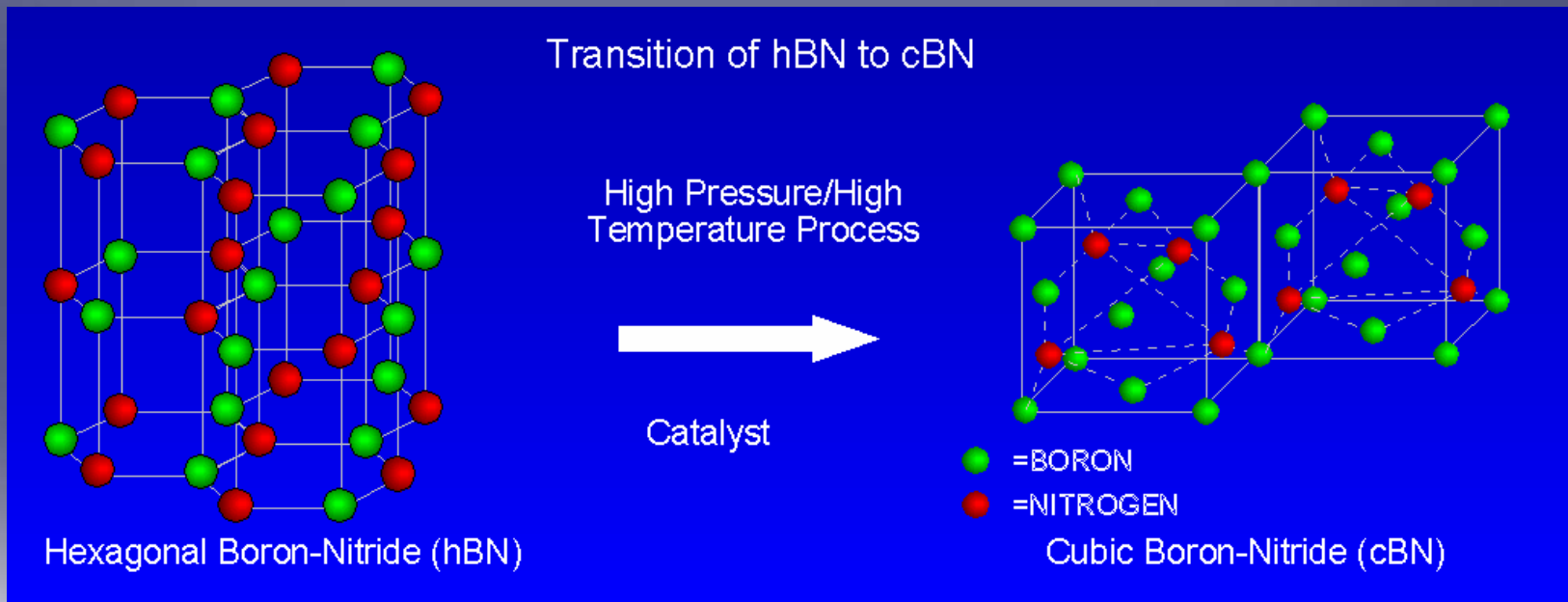
- Ultra – hard materials (PCD & PCBN)
- Oil & Gas drilling
- Mining & Construction (mining, water-well, exploration, quarrying, tunneling, building constructions)
- Cutting tool industry (automotive, aircraft)
- Friction Stir Welding of steel (Proprietary technology)

Background

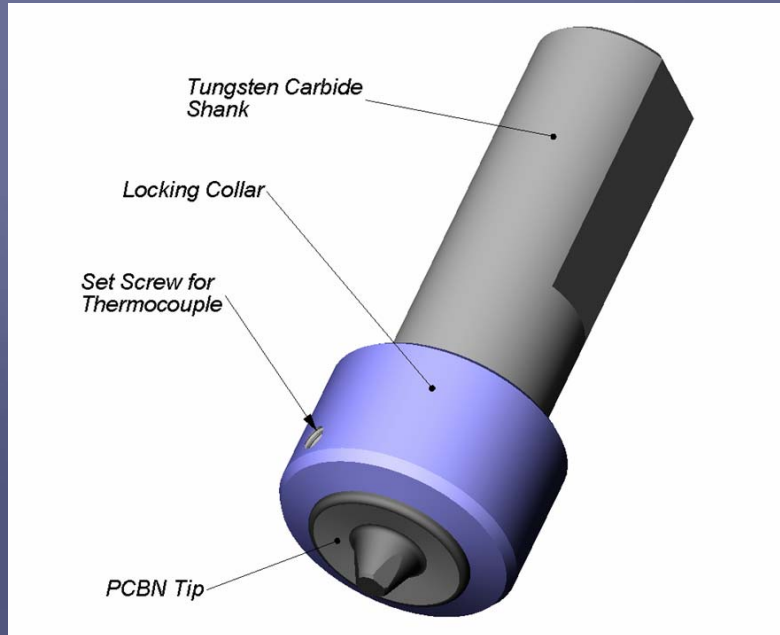
- 26 years Sandvik AB, Sweden and USA
- 8 years MegaDiamond Inc., USA
- Executive positions in Engineering, R&D, Sales&Marketing, Product Line Management, Business Development, GM
- Extensive international net work
- Currently an authorized representative for MegaDiamond and MegaStir

Polycrystalline Cubic Boron Nitride (PCBN)

- **PCBN is a Synthetic Super Abrasive Material**
 - **Created in HT-UHP presses (1450 C, 1000 KSI)**

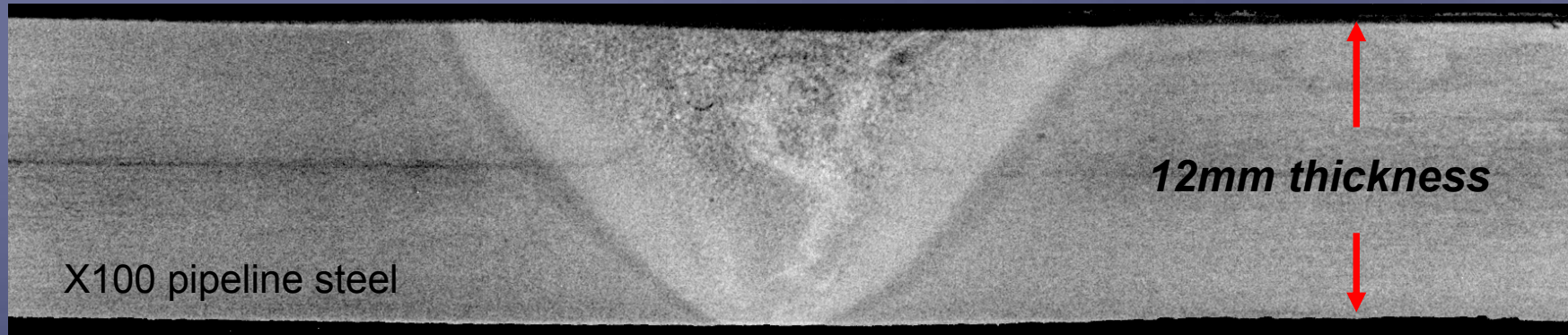


FSW of Hard Metals



- ***Polycrystalline Cubic Boron Nitride (PCBN) used for welding steels, stainless steels, nickel base and other higher melting temperature materials.***

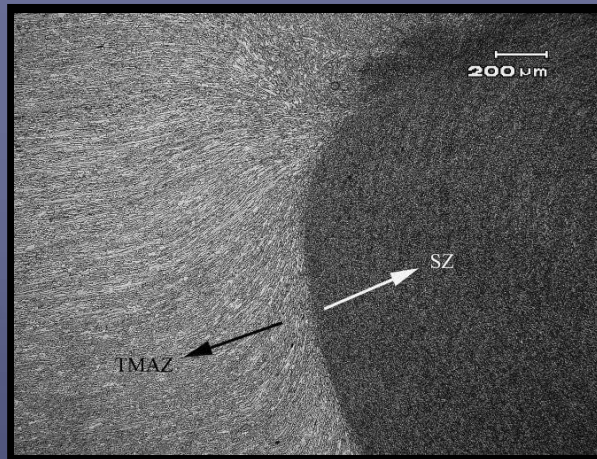
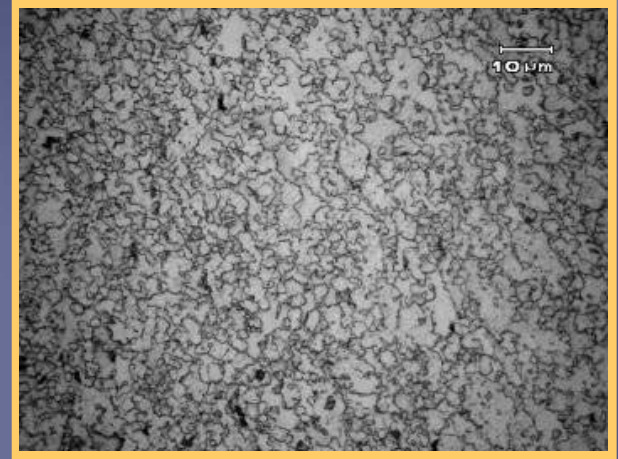
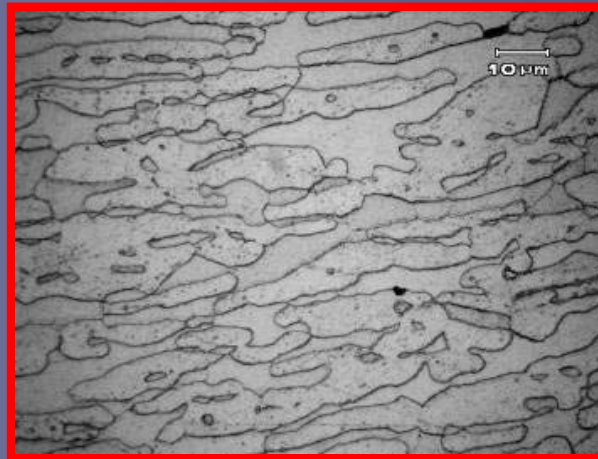
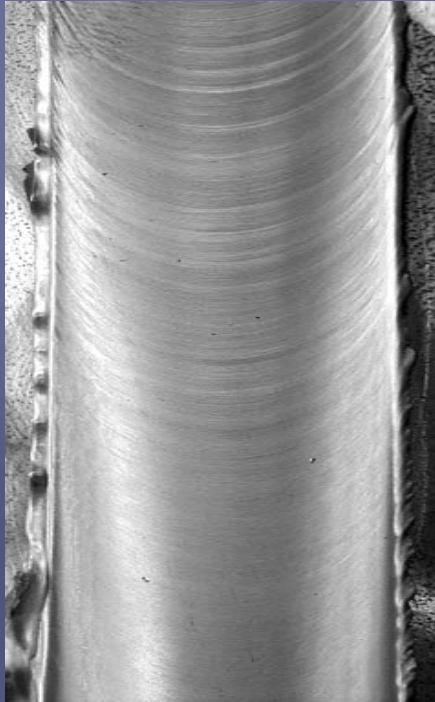
Full Penetration Single Pass Welding



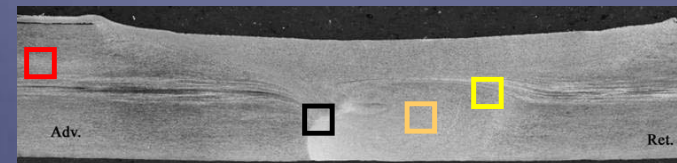
Full penetration weld with properties similar to the base material



2205 Duplex Stainless Steel

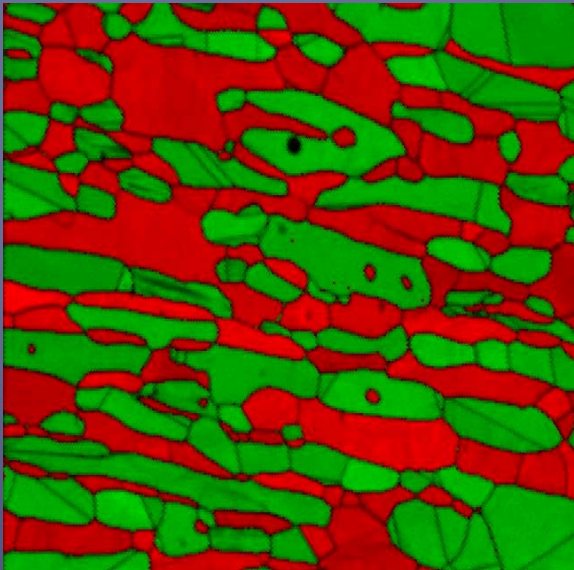


• Grain refinement exhibited in Stir Zone





OIM™ Analysis of 2205

Base Metal

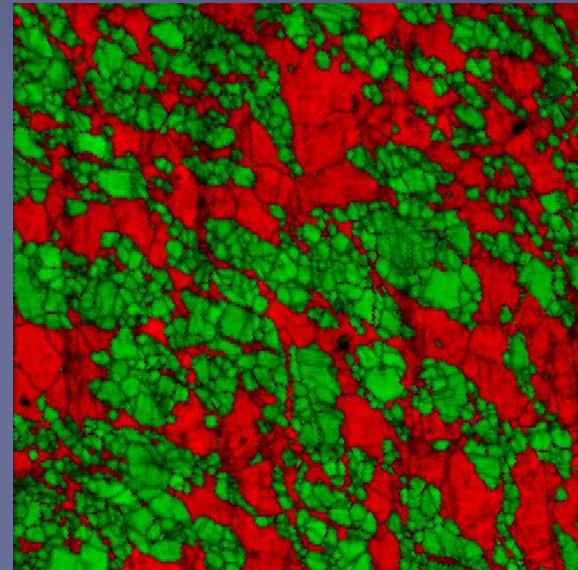


50.00 μm = 50 steps IQ 9.429...92.401, Phase

Color Coded Map Type: Phase



	Phase	Total Fraction	Partition Fraction
	bcc	0.484	0.484
	fcc	0.516	0.516

Stir Zone



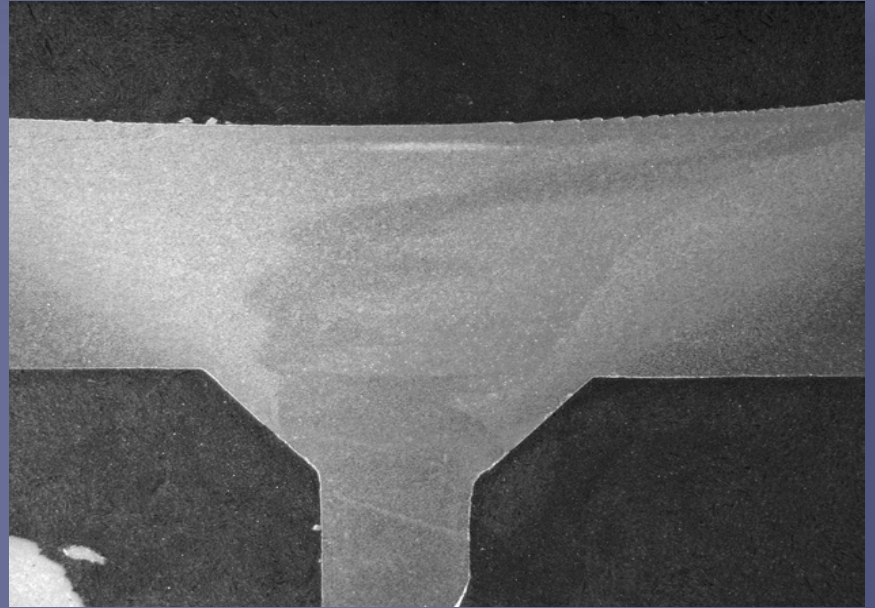
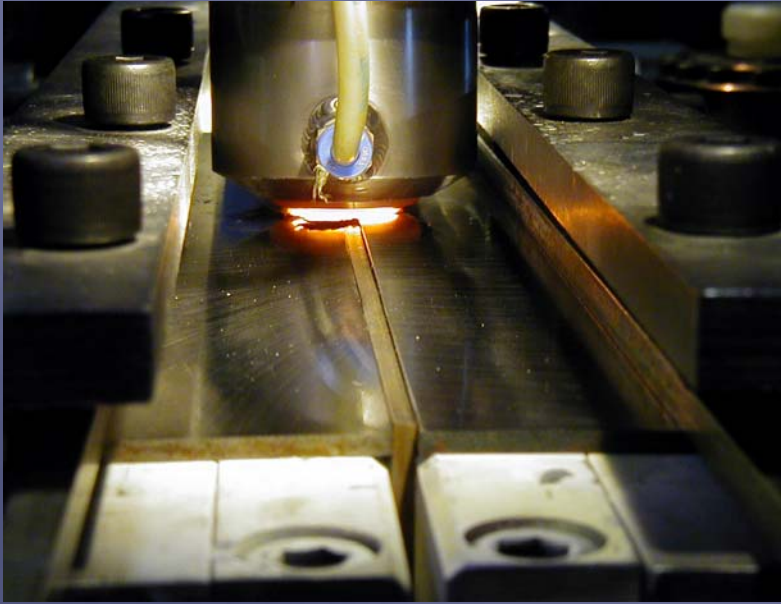
50.00 μm = 50 steps IQ 8.784...78.789, Phase

Color Coded Map Type: Phase

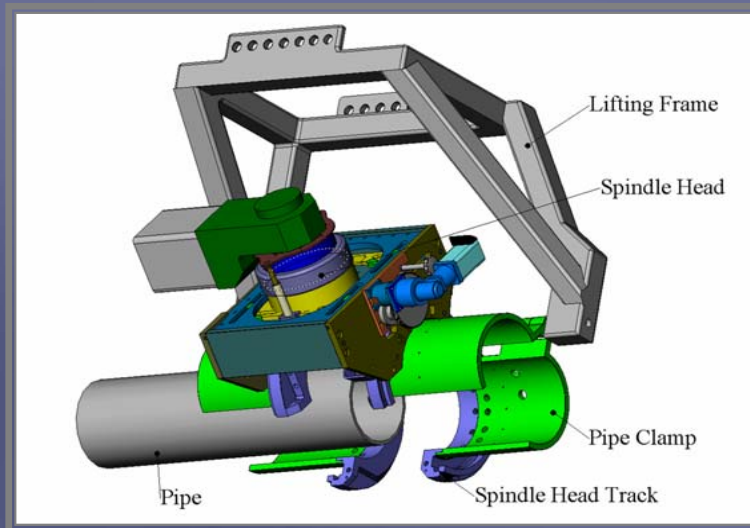
	Phase	Total Fraction	Partition Fraction
	bcc	0.482	0.482
	fcc	0.518	0.518

- Austenite-Ferrite ratio maintained
- Critical Pitting Temperature (CPT) 20°C higher than arc-welding processes

T-Joint Configurations



Circumferential Welding



Prototype circumferential welding machine

Spot FSW



- Cycle times equivalent to resistant spot welding
- Able to join unweldable alloys (Dual phase, TRIP, Boron Steels) both Zinc coated and uncoated

Under water FSW



- Welding and crack repair under water

304L Stainless Steel

Joining Bit Design

Alloy Steel

- 4142 (53-57 R_c)
- D2 (61-64 R_c)

