

**AT EaziGoFlo® FD - Erosion Resistant Sand Screen  
The Boron Diffused Solution**

**T O D A Y ' S T O P I C**

**The Strong Boron Surface Finish**



# The Strong Boronized Surface Finish

Our approach in June 2020:

What is the status quo and what has to be realized to improve existing product?

- On current Erosion resistant solutions of screens in the market
  - What are the Disadvantages?
- Which solution in the market is available, proven and accepted for better performance:

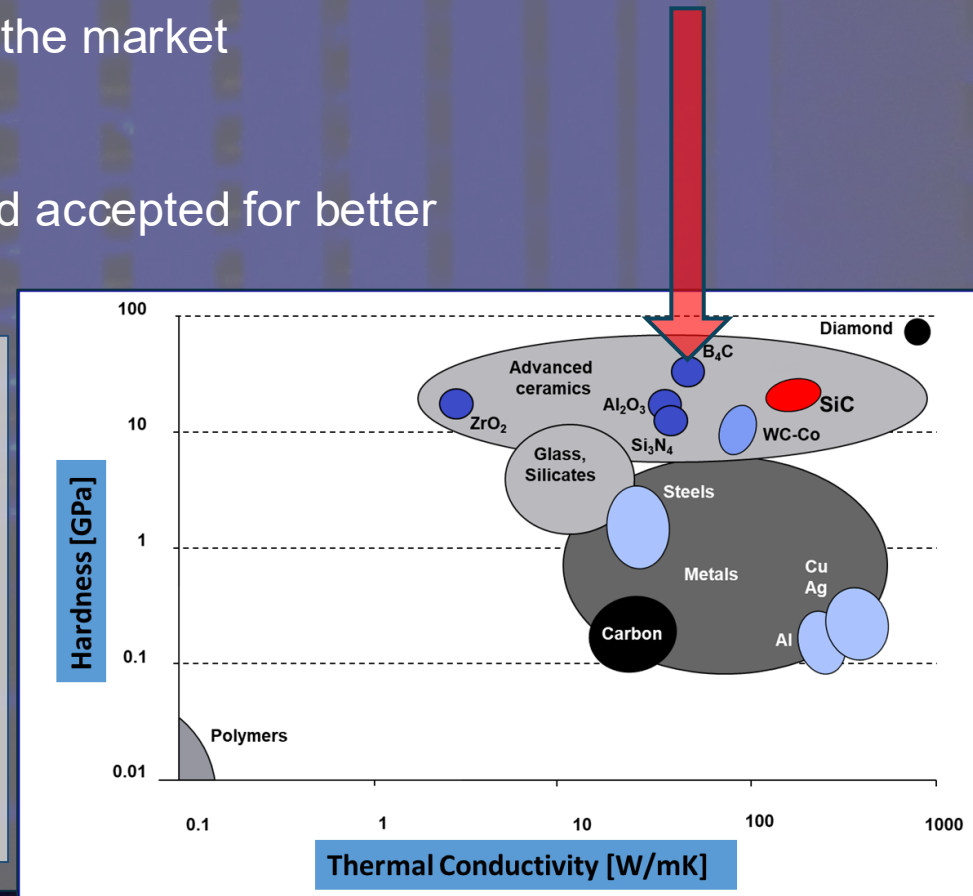
- Material
- Erosion
- Corrosion
- Type of Screen

## Used Materials in the market

- Stainless Steel...
- SiC – Company X
- WC-Co – Company Y
- ZrO<sub>2</sub> – Company Y
- B<sub>4</sub>C – ???

## Exceptional resistance to wear:

The higher the hardness, the lower the erosion



# The Strong Boronized Surface Finish

Our (shu-)smart screen solution, the most optimized Screen on the market in terms of Design, Hardness and Longevity, comes with a metal body (mainly SS 316L) and a diffused strong Boronized surface finish. (Pat. Pending)

That makes this Screen as strong as a ceramic Screen, but without being brittle.

## Exceptional resistance to wear:

The higher the hardness, the lower the erosion



# The Strong Boronized Surface Finish

## Boronizing for ferrous metals

- **Boriding** is a thermochemical surface treatment for ferrous metals where boron diffuses into the metal surface to provide an extremely hard and wear-resistant surface layer. The method is suitable for components which are exposed to extreme adhesive wear or abrasion and where other treatments reach their limits.

All ferrous materials as well as numerous high alloy steels are suitable for boriding

- Adhesion between the boride layer and the base metal following various degrees of indentation, **see micrographs of boride layers on following slide.**

### Exceptional resistance to wear:

The higher the hardness, the lower the erosion



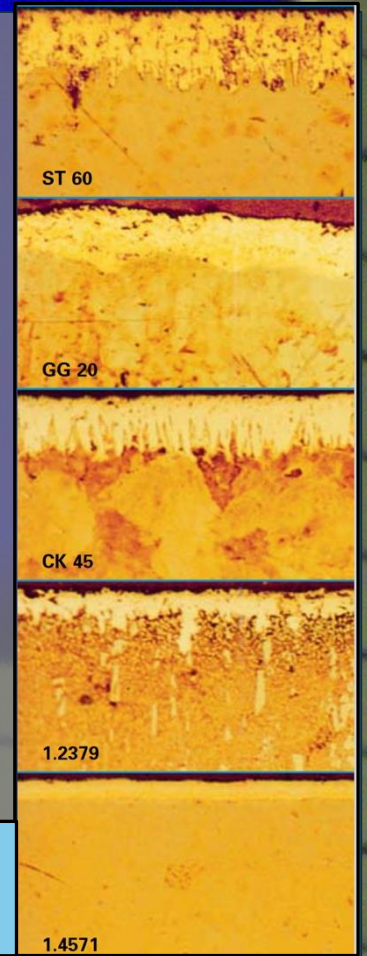
# The Strong Boronized Surface Finish

Various base material properties are clearly enhanced by boriding, including

- Surface hardness – up to 8 times higher than before boriding
- Hot hardness
- Corrosion resistance to alkali and non oxidizing acids
- Erosion resistance
- Cavitation resistance

After boriding, several features remain unaffected, including

- Resistance to heat shocks
- Thermal conductivity
- Electric conductivity
- Thermal expansion
- Material elasticity



Micrographs of boride layers - various materials

resources



**Exceptional resistance to wear:**

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# The Strong Boronized Surface Finish

Wire Wrapped Screen treated with Boron in furnace  
Specification

- Hardness for  $B_4C$ : 29.5 – 33 GPa

Testing after SPE-191942-MS

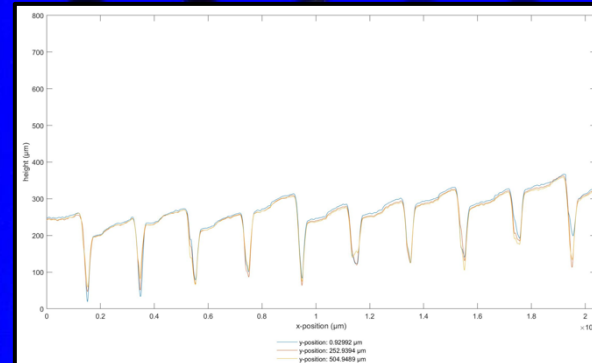
- First Test for 48h to get an impression.
- No Erosion under microscope to see
- No weight loss after 48h Testing

## Advantages

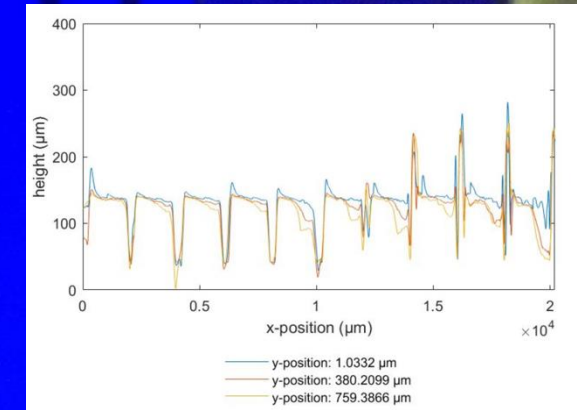
- Proven Wire Wrapped Screen Application (++)
- No BasePipe – Flow Environment (++)
- No Coating (++)
- Full coverage inside screen (++)
- Keeping sharp edges after treatment with Boron (++)
- Very competitive in pricing and investment return (++)

**Exceptional resistance to wear:**

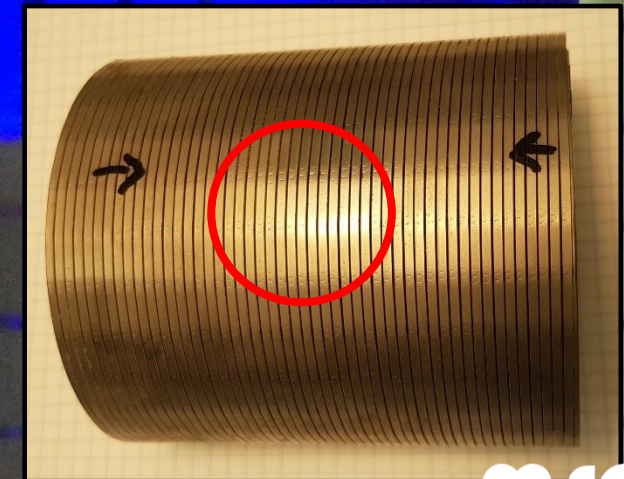
The higher the hardness, the lower the erosion



Source: Fraunhofer IEG, before Test



Source: Fraunhofer IEG, after 48h



Source: msc resources AB



# The Strong Boronized Surface Finish

Advanced Screen	Company	Design	Knoop Hardness in GPa	SPE-191942	Result	Advantages / Disadvantages
<b>Basic Wire Wrapped Screen without BasePipe</b> <b>XT EaziGoFlo Sand Screen</b>	Different	Wire Wrapped Screen. Stainless Steel. With/No Basepipe.	< 0.5	2h Testing	Average increase in gap aperture size is 114.0 µm.	Design (++) Sharp edges for bridge building (++) Material against Erosion (--)
<b>Hard Metal / Ceramic Coated Screen</b>	Company Y	Wire Wrapped Screen. Stainless Steel. No Basepipe. Outside coating with Hard Metal or ZrO <sub>2</sub> .	Hard Metal: 16 ZrO <sub>2</sub> : max. 21.7	48h Testing	Erosion for all coating surfaces: 140µm to > 300µm.	Coating can get loose (-) No coverage inside screen (-) No sharp edges for bridge building (-)
<b>SiC Ceramic Screen</b>	Company X	Build from SiC and Stainless Steel. With Basepipe. SiC Rings stacked above each other. Hold in place with springs.	21 – 25	48h Testing	Average increase in gap aperture size is 23.4 µm.	Material (+) SiC rings are very brittle (-) If one ring or a spring breaks, the whole screen falls apart (--)
<b>EaziGoFlo® Sand Screen</b>	msc resources AB	Wire Wrapped Screen. Stainless Steel. No Basepipe. Treated with Boron in Furnace.	29.5 – 33	48h Testing	No Erosion under microscope.	Proven Wire Wrapped Screen App. (++) No BasePipe – Flow environment (++) No Coating (++) Full coverage inside screen (++) Sharp edges after treatment with Boron (+)

**Exceptional resistance to wear:**

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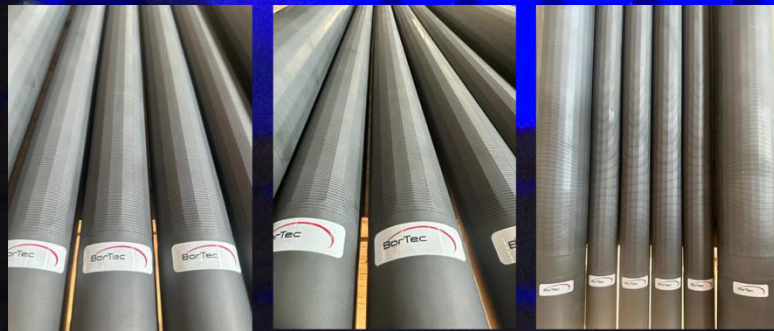


# The Strong Boronized Surface Finish

The **new Flushed Design** sand screen has the following advantages compared to the Standard Design sand screen:

- Flushed design – for the screen modules (2m long) and in-between the same OD throughout
- Larger outer diameter of the filter modules
- Correspondingly larger open area
- Improved hydraulic performance
- Higher strength characteristics

The new Flushed Design sand screen has higher tensile strength where it is achieved by using a larger support rod. In any case, for any sizes/diameters, the Flushed Design will always have strength no less than the Standard Design, and in most cases even exceed the strength of the Standard Design (using non-standard pipe with larger wall thickness).



## Exceptional resistance to wear:

The higher the hardness, the lower the erosion

# The Strong Boronized Surface Finish

## Oil & Gas Equipment

Some examples of the equipment which have been treated with Boron:



Swing Check Valve:  
Boronized on the internal trim & flow path



Production Tubing  
& Pup Joints



ESP Stages



Couplings

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**BorTec**  
THE EXPERTS FOR WEAR PROTECTION

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Equipment and Services for Underground Operations for O&G, Water, Geothermal and Mining

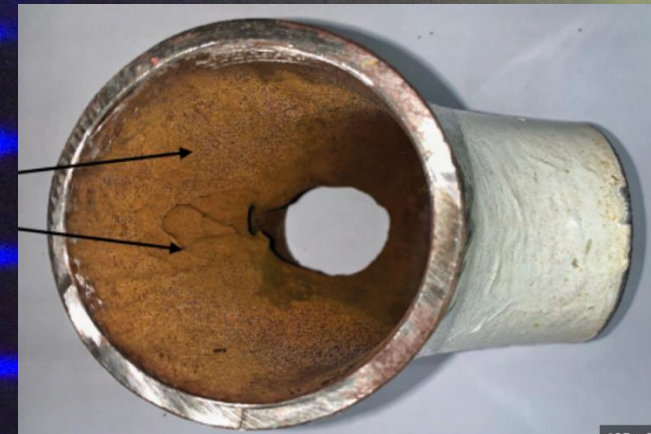
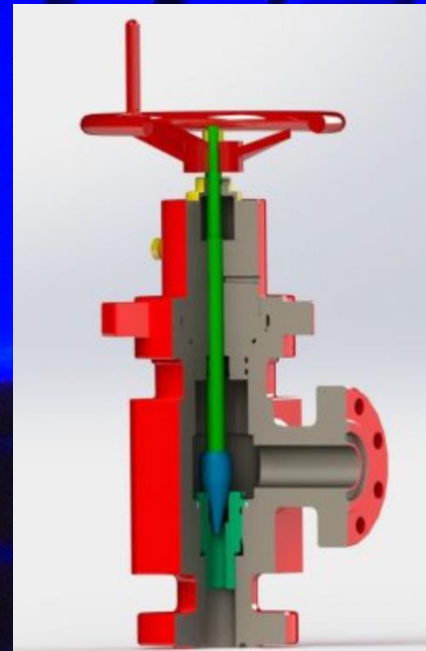
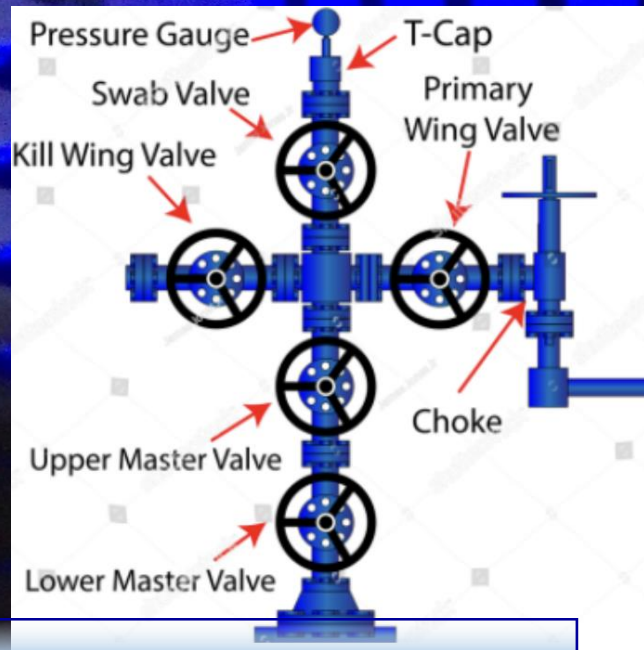
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# The Strong Boronized Surface Finish

## Surface Equipment

Surface equipment which face erosion issue (as well as corrosion) such as wellhead's choke valve, Lower Control Valve, CHPS pump, elbows, etc. can be treated with Boron



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