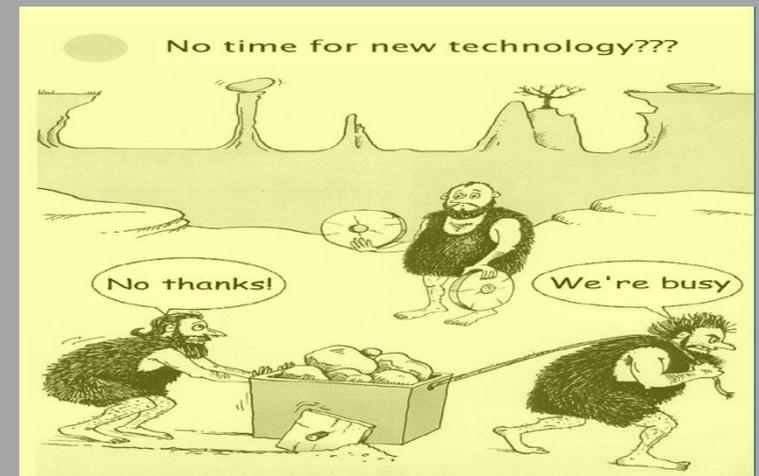


World's First Installation Of Boron Diffused Erosion Resistant Through Tubing Sand Screen In A Producing Gas Field

Martin Schuster,
msc resources AB





Society of Petroleum Engineers

SPE Annual Caspian Technical Conference and Exhibition

25–27 November 2025
Baku, Azerbaijan

Presentation Outline

- **Basics for the to-be-designed Sand Screen**
- Armoring Technology - Extreme hardness for metal tools
- The Boron Diffused Erosion Resistant Through Tubing Sand Screen
- Development in the first Producing Gas Field
- Conclusions and Way Forward

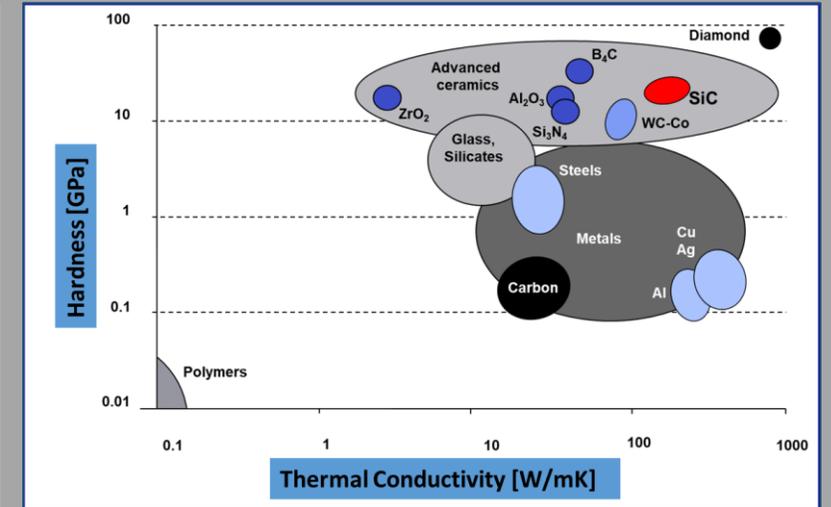


Society of Petroleum Engineers

2012

1. Basic

The higher the hardness, the lower the erosion results in an exceptional resistance to wear

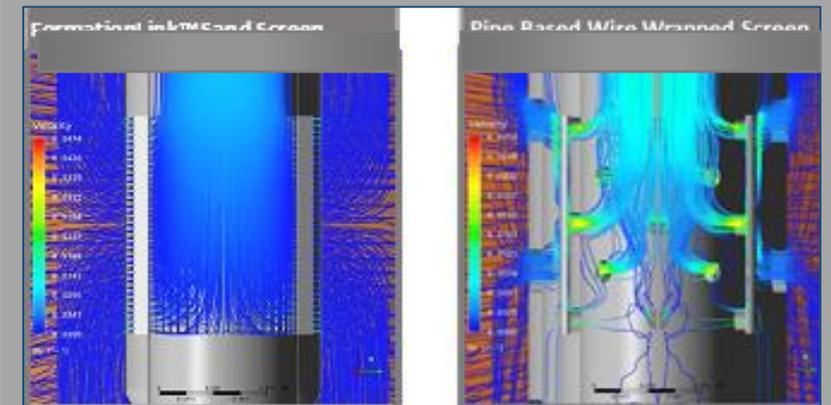


2014

2. Basic

The flow of fluids always follows the directest path and has no tendency to go around corners or change direction on its own.

Law of Hydraulics



Basics for the to-be-designed Sand Screen



Society of Petroleum Engineers

SPE Annual Caspian Technical Conference and Exhibition

25–27 November 2025
Baku, Azerbaijan

Presentation Outline

- Basics for the to-be-designed Sand Screen
- **Armoring Technology - Extreme hardness for metal tools**
- The Boron Diffused Erosion Resistant Through Tubing Sand Screen
- Development in the first Producing Gas Field
- Conclusions and Way Forward



Society of Petroleum Engineers

SPE Annual Caspian Technical
Conference and Exhibition

25–27 November 2025
Baku, Azerbaijan

Armoring Technology - Extreme hardness for metal tools

Boron - remember...extreme hardness...

- **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**



Society of Petroleum Engineers

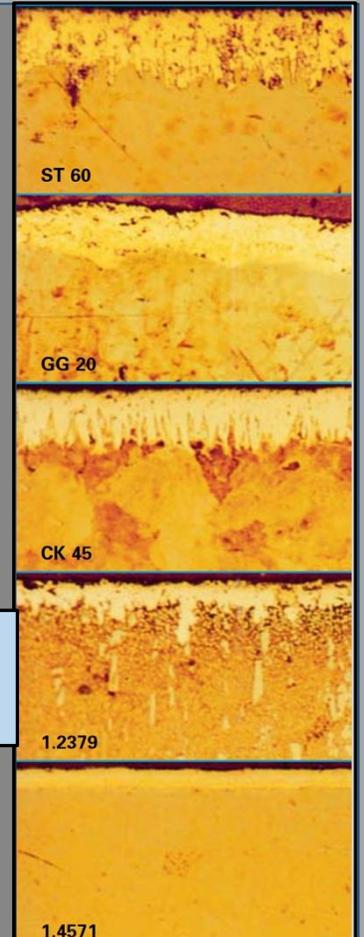
Armoring Technology - Extreme hardness for metal tools

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**



Society of Petroleum Engineers

SPE Annual Caspian Technical Conference and Exhibition

25–27 November 2025
Baku, Azerbaijan

Presentation Outline

- Basics for the to-be-designed Sand Screen
- Armoring Technology - Extreme hardness for metal tools
- **The Boron Diffused Erosion Resistant Through Tubing Sand Screen**
- Development in the first Producing Gas Field
- Conclusions and Way Forward



Society of Petroleum Engineers

Boron Diffused Erosion Resistant Through Tubing Sand Screen

Wire Wrapped Screen treated with Boron in furnace

Specification

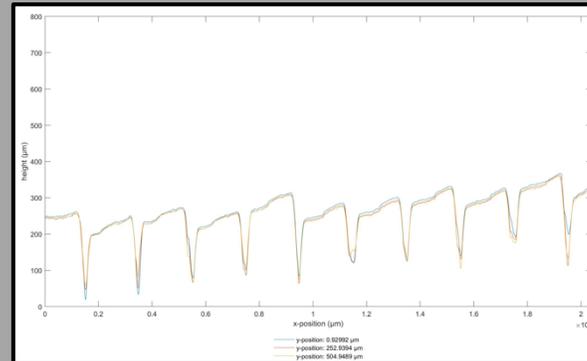
- Hardness for B₄C: 29.5 – 33 GPa
- Hardness for Stainless Steel: < 0,5 GPa

Testing after SPE-191942-MS

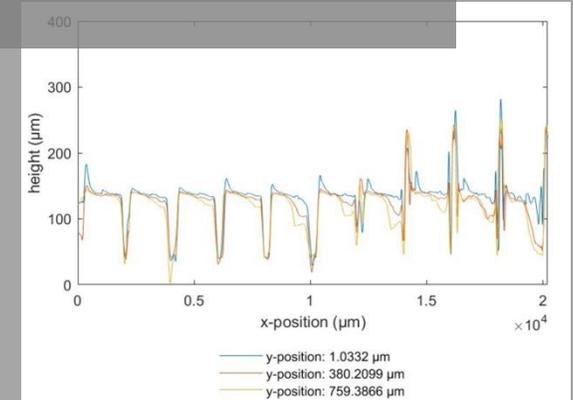
- First Test for 48h to get an impression.
- No Erosion under microscope to see
- No weight loss after 48h Testing

Advantages

- Proven Wire Wrapped Screen Application (++)
- No BasePipe – Flow environment (++)
- No Coating (++)
- Full coverage inside screen (++)
- Still sharp edges after treatment with Boron (++)



Source: Fraunhofer IEG, before Test



Source: Fraunhofer IEG, after 48h



Source: Fraunhofer IEG



Society of Petroleum Engineers

SPE Annual Caspian Technical Conference and Exhibition

25–27 November 2025
Baku, Azerbaijan

Presentation Outline

- Basics for the to-be-designed Sand Screen
- Armoring Technology - Extreme hardness for metal tools
- The Boron Diffused Erosion Resistant Through Tubing Sand Screen
- **Development in the first Producing Gas Field**
- Conclusions and Way Forward



Society of Petroleum Engineers

SPE Annual Caspian Technical
Conference and Exhibition

25–27 November 2025
Baku, Azerbaijan

Development in the first Producing Gas Field

An overview of the implementation of novel technology.

Boron diffused ER TTSS represents an advancement of the conventional wire wrapped screen (WWS).

The WWS design features a simple open structure without a base pipe, making it versatile for various installation requirements.

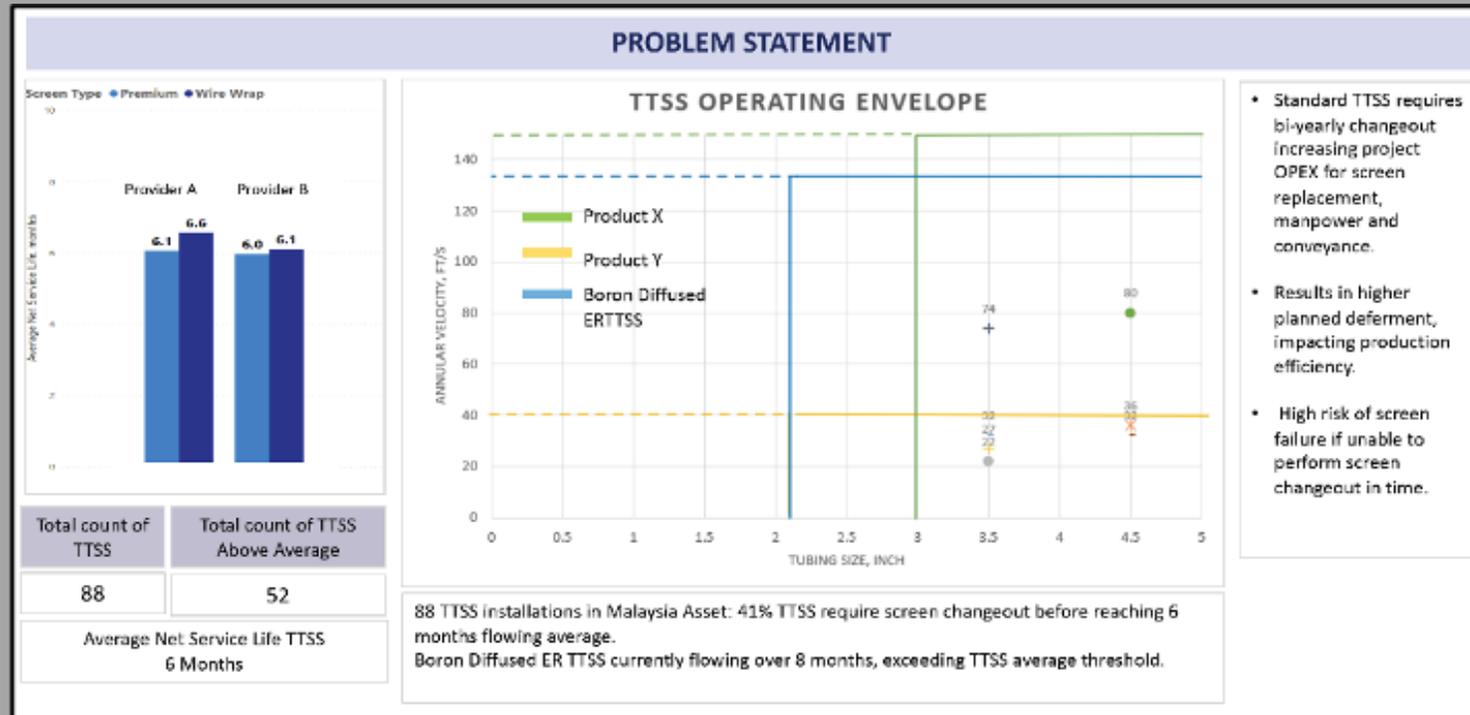
The distinctive aspect of this design lies in the boriding process, where the WWS undergoes treatment with Boron Carbide in a furnace, creating an exceptionally hard and wear-resistant surface layer in addition to enhancing resistance against high-speed corrosion and erosion.

A new designed Flushed OD of the Screen over the whole Screen Module



Society of Petroleum Engineers

Development in the first Producing Gas Field



PROBLEM STATEMENT

Source: Presentation at APOGCE 10.-12-Oct 2022, Jakarta.
SPE-Paper 215200-MS World's First Pilot Installation of Boron Diffused Erosion Resistant Through Tubing Sand Screen (ER TTSS) in a Producing Gas Field: A Novel Application in Peninsular Malaysia



Society of Petroleum Engineers

Development in the first Producing Gas Field

Production	Installation	Flow Period in days	Av. Net Service Life	Current Production
Stand 31.12.2023				
Previously installed TTSS	88	∅ 183	 	No
<i>Boron Diffused</i> ER TTSS				
Well-1	Dec 2022	393		Yes
Well-2	Dec 2022	385		Yes
Well-3	Dec 2022	378		Yes
Well-4	Jan 2023	362		Yes
Well-5	Jan 2023	354		Yes
Well-6	Jan 2023	343		Yes
Well-7	May 2023	223		Yes

ANALYSIS & RESULTS

Source: Msc Resources AB, Sweden





Society of Petroleum Engineers

Development in the first Producing Gas Field

SPE-215200-MS

- The paper was presented at the SPE/IATMI Asia Pacific Oil & Gas Conference and Exhibition held in Jakarta, Indonesia on 10 – 12 October 2023
- Presented together with PETRONAS, Reservoir Link and MSC Resources AB
- Title: **World's First Pilot Installation of Boron Diffused Erosion Resistant Through Tubing Sand Screen (ERTTSS) in a Producing Gas Field: A Novel Application in Peninsular Malaysia**
-” The wells underwent a 6-month flow period during which frequent sampling was conducted. As a pilot project, various success criteria were established as part of the performance metrics such as proposed target rate versus actual flowing parameters, screen condition post retrieval, effective screen lifespan and slot size tolerance. The implementation of Boron sand screens has yielded a profit of USD\$34 million, as demonstrated by the significant increase of 40 MMscfd in production after several months. The payout period was achieved in less than a month of production”....



Society of Petroleum Engineers

SPE Annual Caspian Technical Conference and Exhibition

25–27 November 2025
Baku, Azerbaijan

Presentation Outline

- Basics for the to-be-designed Sand Screen
- Armoring Technology - Extreme hardness for metal tools
- The Boron Diffused Erosion Resistant Through Tubing Sand Screen
- Development in the first Producing Gas Field
- **Conclusions and Way Forward**



Society of Petroleum Engineers

SPE Annual Caspian Technical Conference and Exhibition

25–27 November 2025
Baku, Azerbaijan

Conclusions and Way Forward

- **Installation of Boron Diffused ER TTSS in 7 strings have proven to be successful with target rates achieved and enhancement gain of 40 MMscfd with zero sand count**
- **To provide overall close out on Boron Diffused ER TTSS application as new technology for sand remedial control.**
- **To replicate the Boron Diffused ERTTSS technology at other fields in Malaysia and Indonesia Assets as their remedial sand control barrier.**
- **24 more strings ER TTSS have been ordered and currently placed in 2024/2025.**



Society of Petroleum Engineers

SPE Annual Caspian Technical
Conference and Exhibition

25–27 November 2025
Baku, Azerbaijan

Vielen Dank für ihre Aufmerksamkeit

