

## SESSION 2

### NEW TECHNOLOGIES FOR STRETCH-BEND-LEVELING LINES FOR THIN MATERIALS MADE OF COPPER AND STAINLESS STEEL AND SPECIAL ALLOYS

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# IWCC LEGAL DISCLAIMER

*The purpose of this presentation is to guide programs benefiting the copper industry and to provide attendees with information to make independent business decisions.*

# Agenda



## **b+s group**

Introduction of the group members



## Leveling

The basic principles of leveling



## **Stretch-Bend-Leveling**

Design and function of a Stretch-Bend-Leveling Line

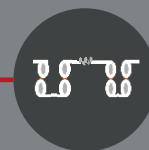
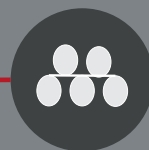


## Outlook

Trends and prospects



# Introduction of the b+s group members



Founded in **1945**



since **1995**



Management & Owner: Achim Kunz and Thomas Baral

**85**

Employees total



**> 1.500**

Lines and machines delivered



**World Market Leader**  
for Stretch-Bend-Leveling Lines



**15**



CNC-Machining Centers for high precision parts

**Market Leader**

for high-precision slitting lines



**23**



sales agents and/or sales offices

**Own Assembly/Production Shop**

for pre-commissioning at b+s



# Product Portfolio of b+s



- Slitting Lines
- Packaging Lines
- Stretch-Bend-Leveling Lines
- Tension-Levelers
- Levelers
- Cut-to-Length Lines
- Traverse Winder
- Coil Processing Lines
- Retrofit und Modernizations

Founded in **1846**

**30** Employees total

**>550**

levelers delivered worldwide

**World Market Leader**  
for Perforated Sheets

1<sup>st</sup> Leveler in the world built in

**1882**

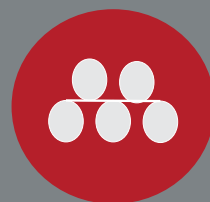
Founded in **1995**

**35** Employees total

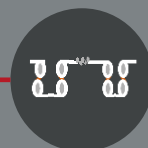
**>70**

SBLs automated

Own developments such as  
precision controls for **CTL**  
**Shears, Traverse Winders** and  
so on



# The basic principles of leveling



# Why is leveling necessary?

- Correction of deformations and/or unevenness in coils or sheets → to achieve laser flat material
- Minimization (homogenization) of internal stresses in the material

# Why is leveling necessary?

## Shape Defects Categories I



Coil Sets



Waves



Cross Bow

Category I occurs when different plastic deformation and elongations occur in the **longitudinal direction** of the strip over the thickness of the sheet. In other words, when the sheet is curved about only one axis.

→ *It leads to inhomogeneous longitudinal residual stresses on the upper and lower sides of the sheet.*

→ Category I can be eliminated by tension forces without bending the leveling rolls, and superimposing tension is not necessary.

## Shape Defects Categories II



Wavy Edges



Center Buckles

Category II is defined by the fact that the coil is **curved** along the **longitudinal axis** and has **varying fiber lengths** across the width. This results in edge or center waves, for example.

→ *inhomogeneous longitudinal and lateral residual stresses*

→ Category II **cannot** be eliminated by simple bending operations. Superimposing tension is necessary.

→ Can be addressed by applying additional tension and/or bending leveling rolls.

A distinction must be made between two types of superimposed tension:

- I. The process of vertically adjusting individual back-ups is a method of reducing internal tensile stresses.
- II. Superimposing tension through S-Bridles → SBL

# Why is Stretch-Bend-Leveling necessary?

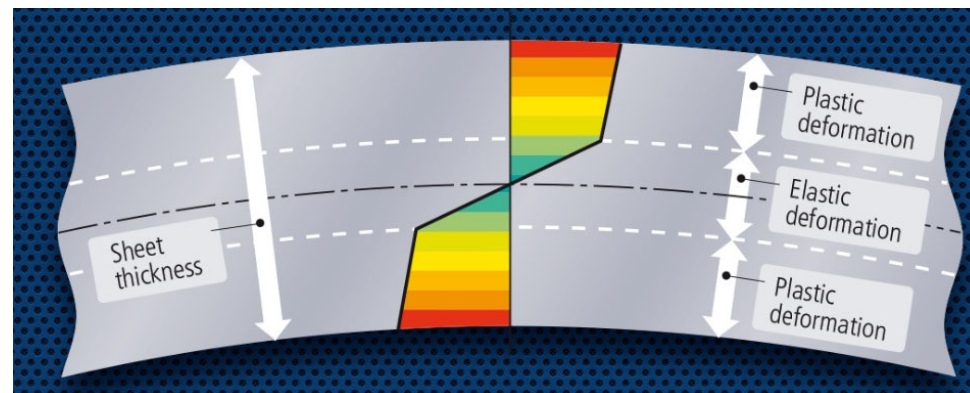
The conventional leveler gives perfect results (flatness and residual stresses) within its limits, depending on the roll diameter and number of rolls.

What are the limitations of the leveler?

- very thin material, especially in combination with high yield strength
- very high line speeds

What is the reason for this?

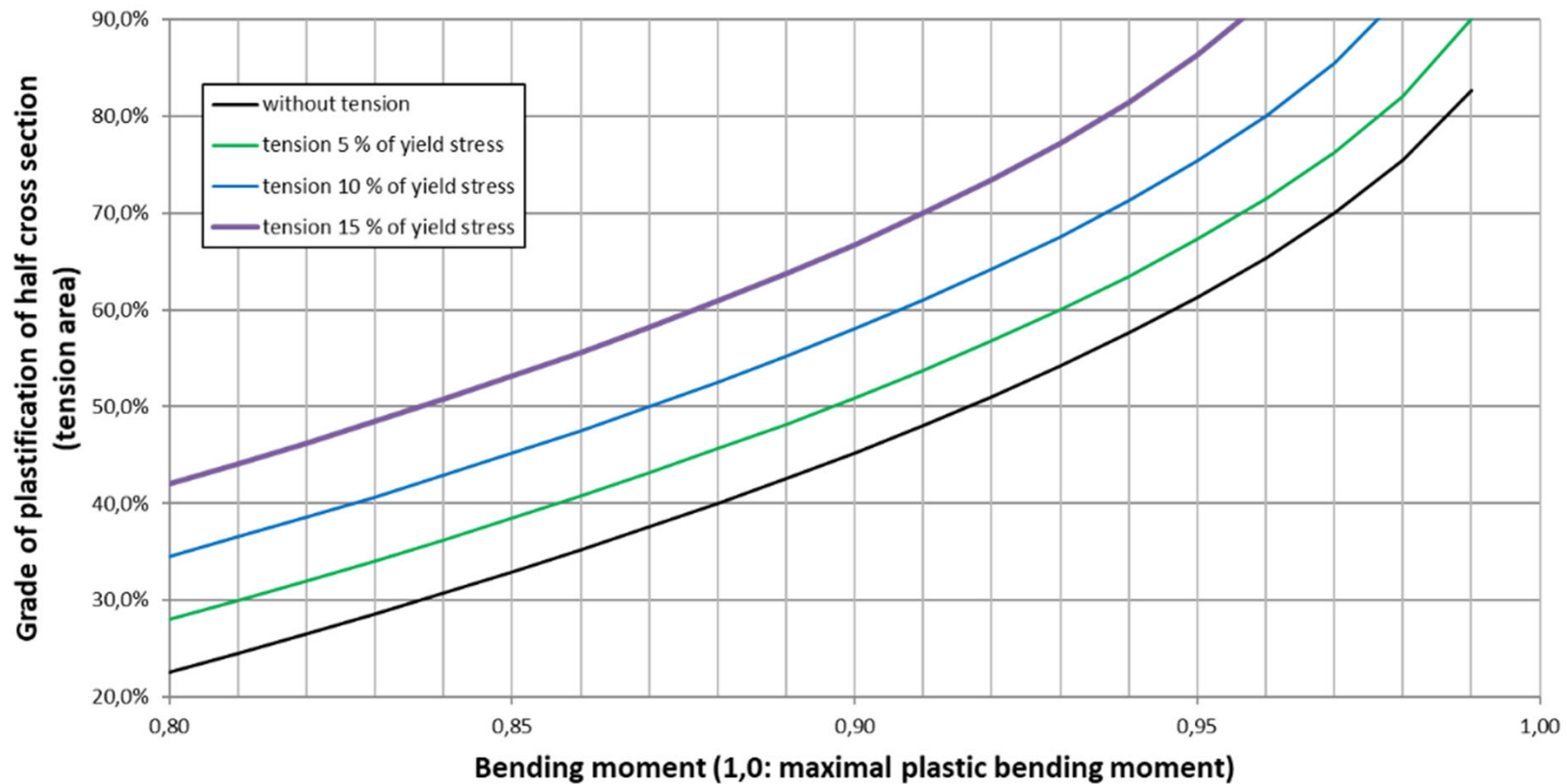
- the achievable degree of plastification of the strip cross section is too low.



# Why is Stretch-Bend-Leveling necessary?

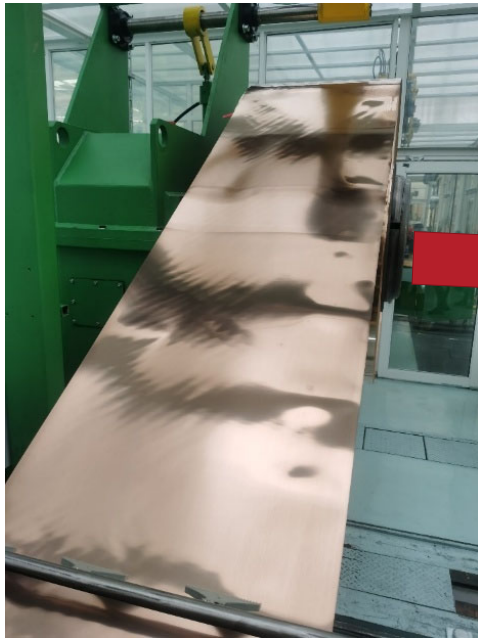
How to overcome limitations of conventional levelers?

→ the material is put under tension, which causes it to stretch



# Why is Stretch-Bend-Leveling necessary?

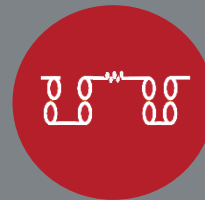
- Stretch-Bend-Leveling achieving best flatness and reducing internal stresses at the same time
- In a Stretch-Bend-Leveler, the combination of stretch leveling and bending occurs simultaneously: the strip is fed through the leveling rolls and at the same time subjected to superimposed tension



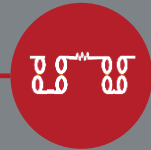
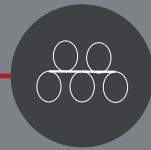
before stretch-bend-leveling



after stretch-bend-leveling



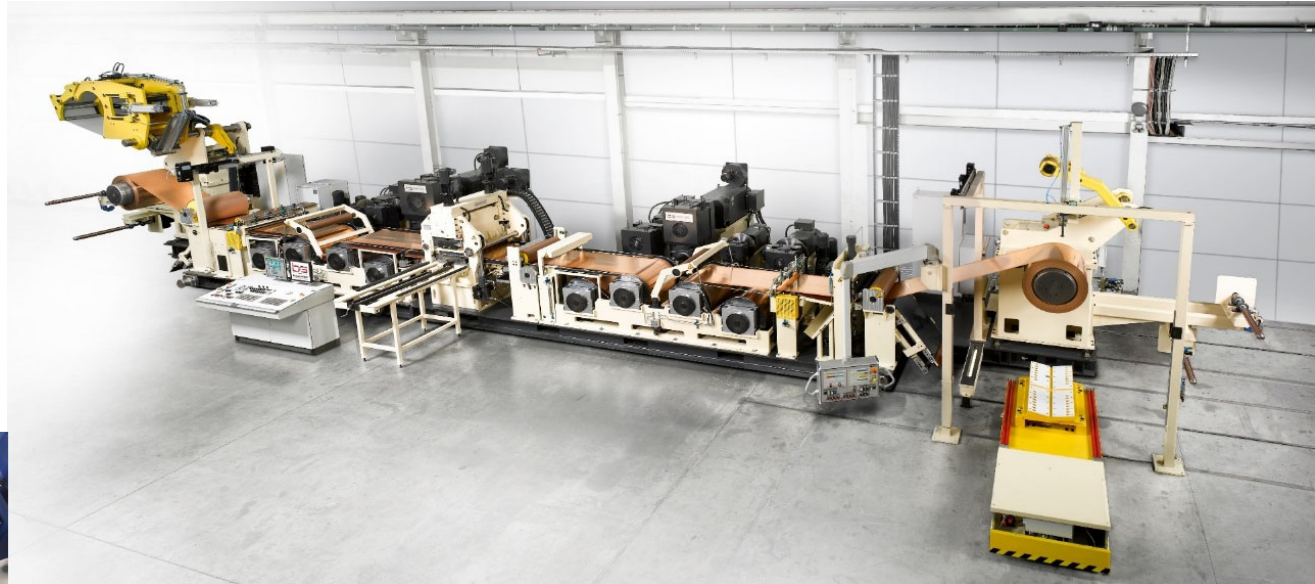
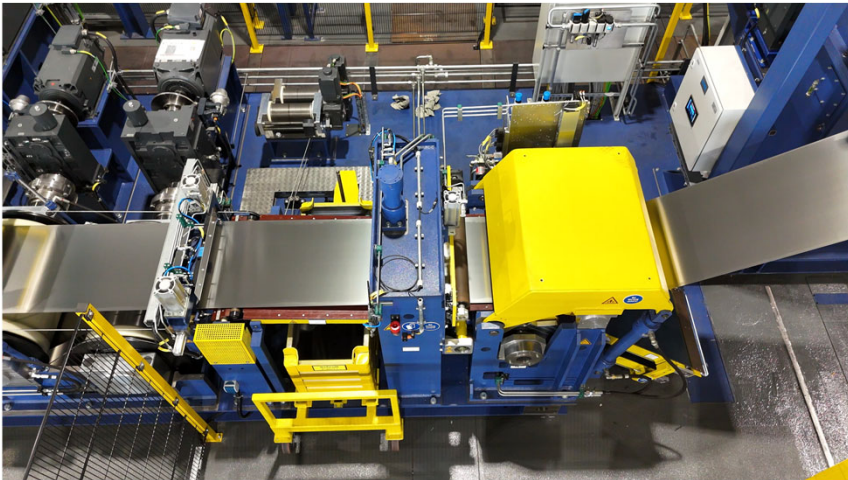
# Design and function of a Stretch-Bend-Leveling Line



# Scope of Application

## Materials:

- Aluminum
- Copper and Alloys
- Stainless Steel
- Zinc



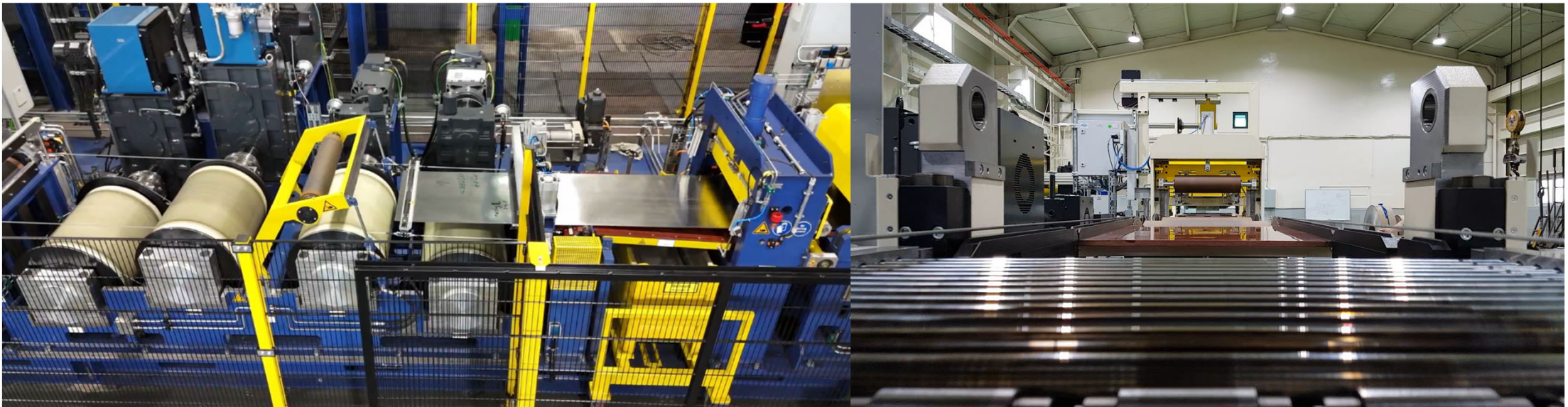
Thickness Range: 0,01 – 2,0 mm [0.0004" – 0.08"]

Width: max. 1.650 mm [65"]

Tensile Strength: max. 2.200 N/mm<sup>2</sup> [320 ksi]

# Functions and Design – Highlights

## Strip Feeding Device



# Functions and Design – Highlights

## Leveler

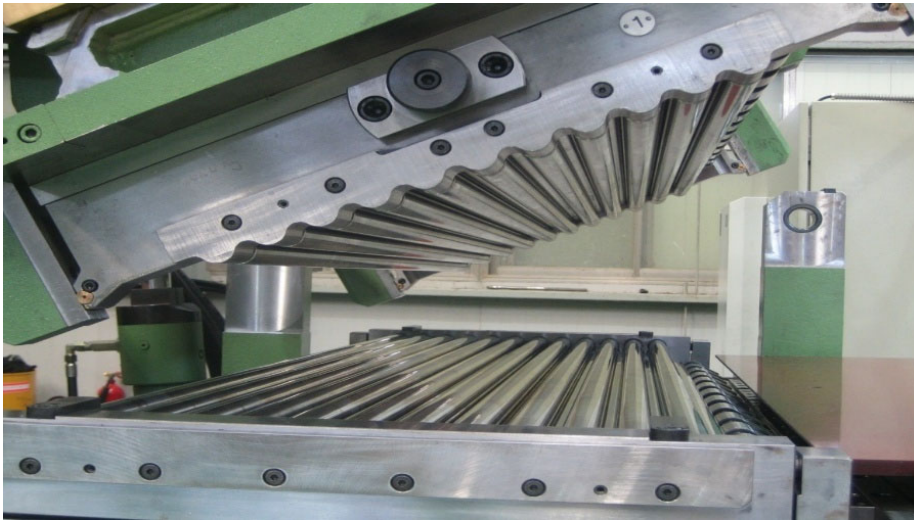
- extremely rigid design
- accuracy of tilting and back-up adjustment <math><3\ \mu\text{m}</math>
- four individually controlled spindles for upper cassette adjustment
- Cleaning and inspection of cassettes by swiveling open the upper leveling cassette



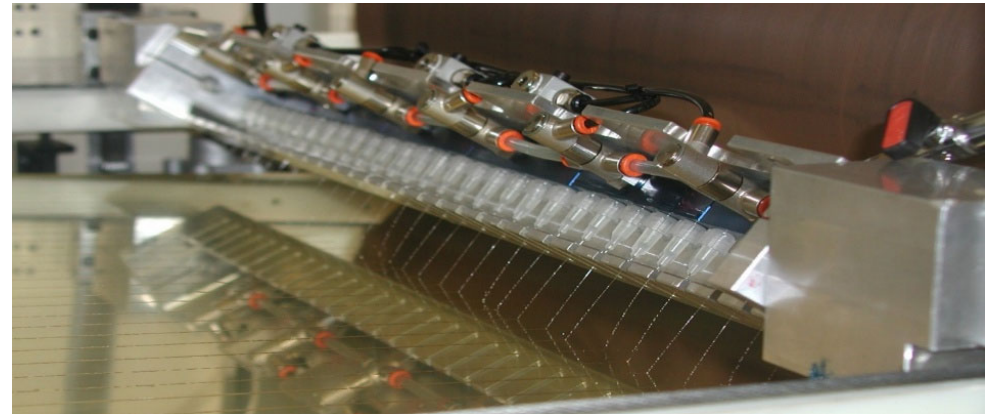
# Functions and Design – Highlights

Leveling Roll Diameters:

- 8 mm, 12 mm, 16 mm, 25 mm

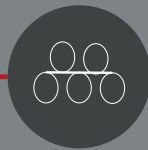


Cleaning system for the leveling cassette





# Trends and prospects



# Trends and Prospects

## 1) Ultra-thin Stretch-Bend-Leveling Lines (from 0,01 mm):

- brake and tension block with several S-bridles and optional dancer control at the entry/exit side of the line
- direct tension measuring on the entry and exit side of the leveler for precise and constant tension
- specially designed controls for precise tension control
- optimization of mechanical components to avoid tension deviations caused by vibrations
- automatic control of strip tension in the leveler area and immersion depth in addition to back-up adjustment

## 2) Reduction of scrap

- the implementation of a flatness measuring roll after the leveler (high tension zone) can reduce the scrap
- mathematical model approach is employed to achieve a further reduction in scrap. The control loop is then closed in the leveler using a model that calculates or models the strip flatness from the support adjustments.
- manual pre-setting of the leveling machine from a database according to flatness errors (edge waves and center buckles)

## 3) „Industry 4.0“ / Artificial Intelligence (AI):

- the possibility of AI seems possible → It is necessary to have access to the coil database
- a common definition / understanding of the term “Industry 4.0” has not yet been established

# Thank You!



[www.b-s-germany.de](http://www.b-s-germany.de)

