“NS blade” / Advanced Air Knife for Hot Dip Continuous Galvanizing Line

NS means Nippon steel & Sumikin engineering.

Hatsuki KAKUNO
Makoto KATSUBE
Muneshige OGAWA
NIPPON STEEL & SUMIKIN ENGINEERING CO., LTD., JAPAN
1. Difficulty of High Speed CGL Operation

- Generation of edge splash and top dross loss in High Speed Operation

As Line Speed increases, zinc-takeout pulled by strip increases.

- Generation of edge splash leads to the loss of zinc consumption.
  ① Top dross loss
  ② Difficulty in thin coating
  ③ Edge over coat

Air knife
↑ Strip
Zinc pot

Diagram:
- Strip
- Coating target
- Over Coat
- Zinc pot
1. Difficulty of High Speed CGL Operation

- Generation of edge splash in High Speed Operation

【Operation condition】Nozzle gap: 20mm, LS: 160mpm, Gas pressure: 0.4kgf/cm²

【Operation condition】Nozzle gap: 20mm, LS: 180mpm, Gas pressure: 0.5kgf/cm²
1. Difficulty of High Speed CGL Operation

Ordinary nozzle Jet collision issue

Wiping gas flow

Wiping width (> Strip width)

Nozzle

Impinging jet

Jet collision

• Splash
• edge over coating

Strip
1. Difficulty of High Speed CGL Operation

- Baffle plate issue

Wiping width (> Strip width)

- Wiping gas flow
- Strip
- Nozzle
- Edge baffle plate
- Ineffective condition
- Less than 5mm
2. Features of NS blade

- Configuration of NS blade Air knife

Cross section of nozzle

- NS blade
- Wiping nozzle
- Wiping gas flow
- Tracking
- Strip
2. Features of NS blade

1. **Non contact** baffle setting
   Safety for high speed operation

2. According to **the jet effect**, EOC and splash shall be avoided even at high speed operation

*EOC: Edge over coating*
3. High speed coating test using NS blade

- Schematic of experiment apparatus

Air pressure

Sound meter

1.5m

Nozzle gap

1.5m

Nozzle

Zinc temperature: 460°C

Strip width: 280mm

Strip thickness: 0.71mm
3. High speed coating test using NS blade

Test results 1 / Edge splash (Front view and side view)

(a) Ordinary nozzle

(b) NS blade
3. High speed coating test using NS blade

Test results 1 / Edge splash (Front view and side view)

【Operation condition】
Nozzle gap: 20mm
LS: 160rpm  Gas pressure: 0.4kgf/cm²

Without NS blade

With NS blade

NS=1.2mm, LS=160rpm, NJ=0.4kg/cm², EB=OFF

NS=1.2mm, LS=160rpm, NJ=0.4kg/cm², EB=ON
3. High speed coating test using NS blade

Flow velocity vector
3. High speed coating test using NS blade

- Test results 2/ Coating thickness distribution

![Graph showing coating weight distribution near the strip edge](image)

- **Coating weight distribution** (near the strip edge)
  - **Target**
  - **Very little variation in the coating weight**

⇒ NS blade is effective in **prevent of Edge over coat** and allow thin coating
3. High speed coating test using NS blade

Test results 3/ Noise level

![Graph showing noise level comparison between Ordinary nozzle and NS blade over different frequencies.](image)
### 4. Commercial line test

<table>
<thead>
<tr>
<th>Operation condition</th>
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#### Galvanizing Line 55% Aluminum+Zinc coating line

<table>
<thead>
<tr>
<th></th>
<th>Galvanizing Line</th>
<th>55% Aluminum+Zinc coating line</th>
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<tbody>
<tr>
<td><strong>Coil spec.</strong></td>
<td>0.23mm thick X 914mm width</td>
<td>0.35mm thick X 1200mm width</td>
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<tr>
<td><strong>Line speed</strong></td>
<td>160mpm</td>
<td>150mpm</td>
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<tr>
<td><strong>Coating thickness</strong></td>
<td>Z08(40g/m² per side)</td>
<td>AZ40(20g/m² per side)</td>
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<tr>
<td><strong>Splash</strong></td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td><strong>Overcoat</strong></td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>
4. Commercial line test

Coating weight distribution

- NS blade
- Ordinary nozzle

Relative Coating thickness [%]

Distance from strip edge [mm]

Left side

Right side

Hatsuki KAKUNO, Makoto KATSUBE, Muneshige OGAWA
NIPPON STEEL & SUMIKIN ENGINEERING CO., LTD., JAPAN
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5. Conclusion

- Coating test at test line ⇒ Reduce EOC, noise level and zinc splash

- Without NS blade
  - NS = 1.2 mm, LS = 160 mpm, NJ = 0.4 kg/cm², EB = OFF

- With NS blade
  - NS = 1.2 mm, LS = 160 mpm, NJ = 0.4 kg/cm², EB = ON

- Commercial line operation (GI and 55% Al+Zinc bath)
  ⇒ Achieve maximum line speed and minimum coating weight operation
Thank you for your attention.