

# High machinability of duplex and use of hollow bar to improve productivity

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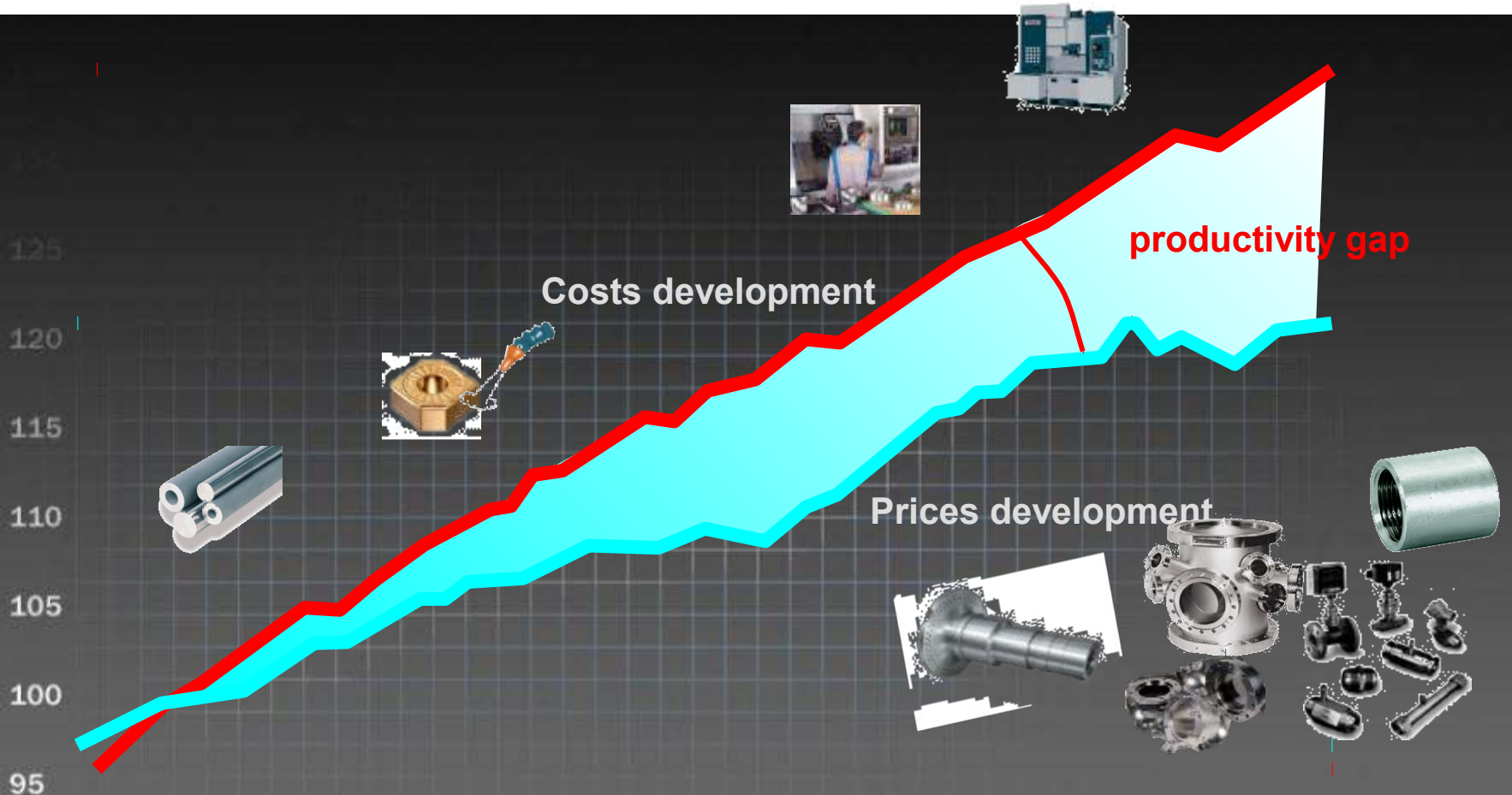
Sandvik Material Technology



# Agenda

- The productivity gap
- Stainless steel material, duplex superduplex, HD
- Hollow bars
- High Machining
- Total cost comparison (forging, bars, hollow bars)

# The productivity gap



Source: Mechanical Industry in OECD

# Productivity

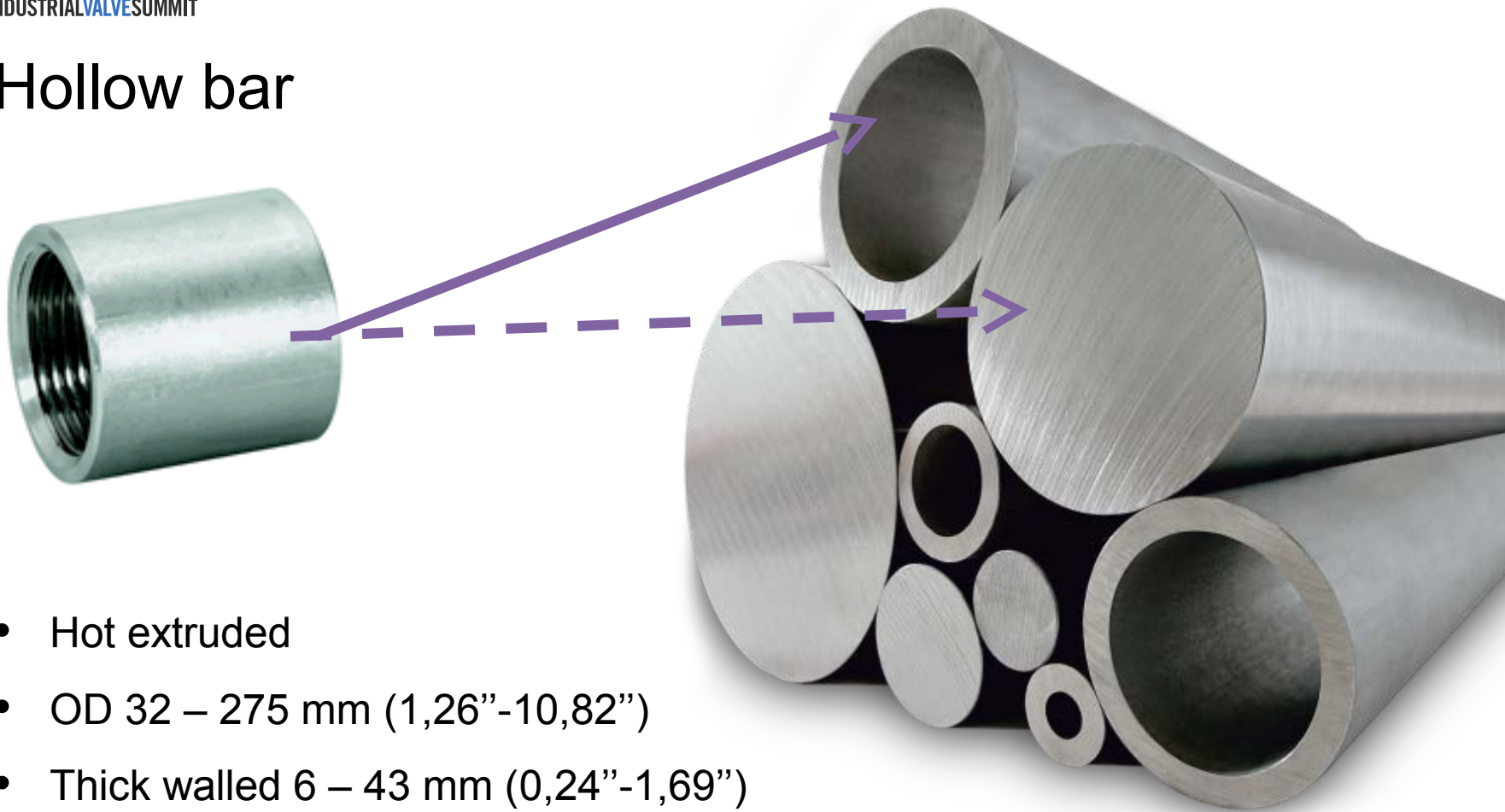
- **Material**
- **Machine tool**
- **Tools**
- **Methods**
- **Knowledge**
- **CNC**



# Duplex materials

- Sandvik 3 RE60 (UNS S31500)
- Sandvik 10 RE51 (UNS S32900)
- Sandvik SAF 2304 (UNS S32304)
- Sandvik SAF 2205 (UNS31803/S32205)
- **Sandvik Sanmac 2205 (UNS31803/S32205)**
- Sandvik SAF 2507 (UNS S32750)
- Sandvik SAF 2906 (UNS S32906)
- Sandvik SAF 2707HD (UNS S32707)
- Sandvik SAF 3207HD (UNS S33207)

## Hollow bar

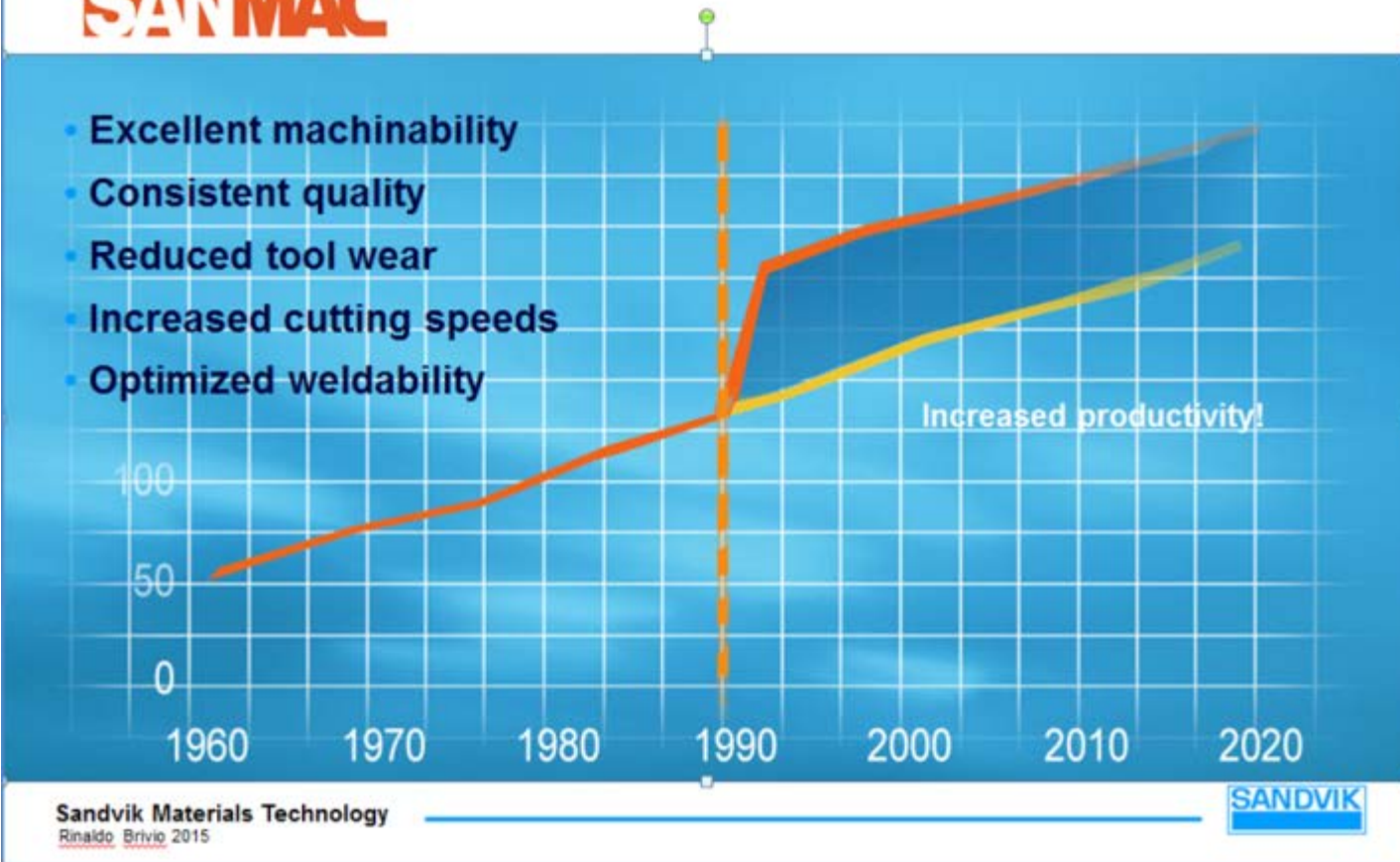


- Hot extruded
- OD 32 – 275 mm (1,26”-10,82”)
- Thick walled 6 – 43 mm (0,24”-1,69”)
- Pickled surface
- Large programme of the standard grades High Machinability

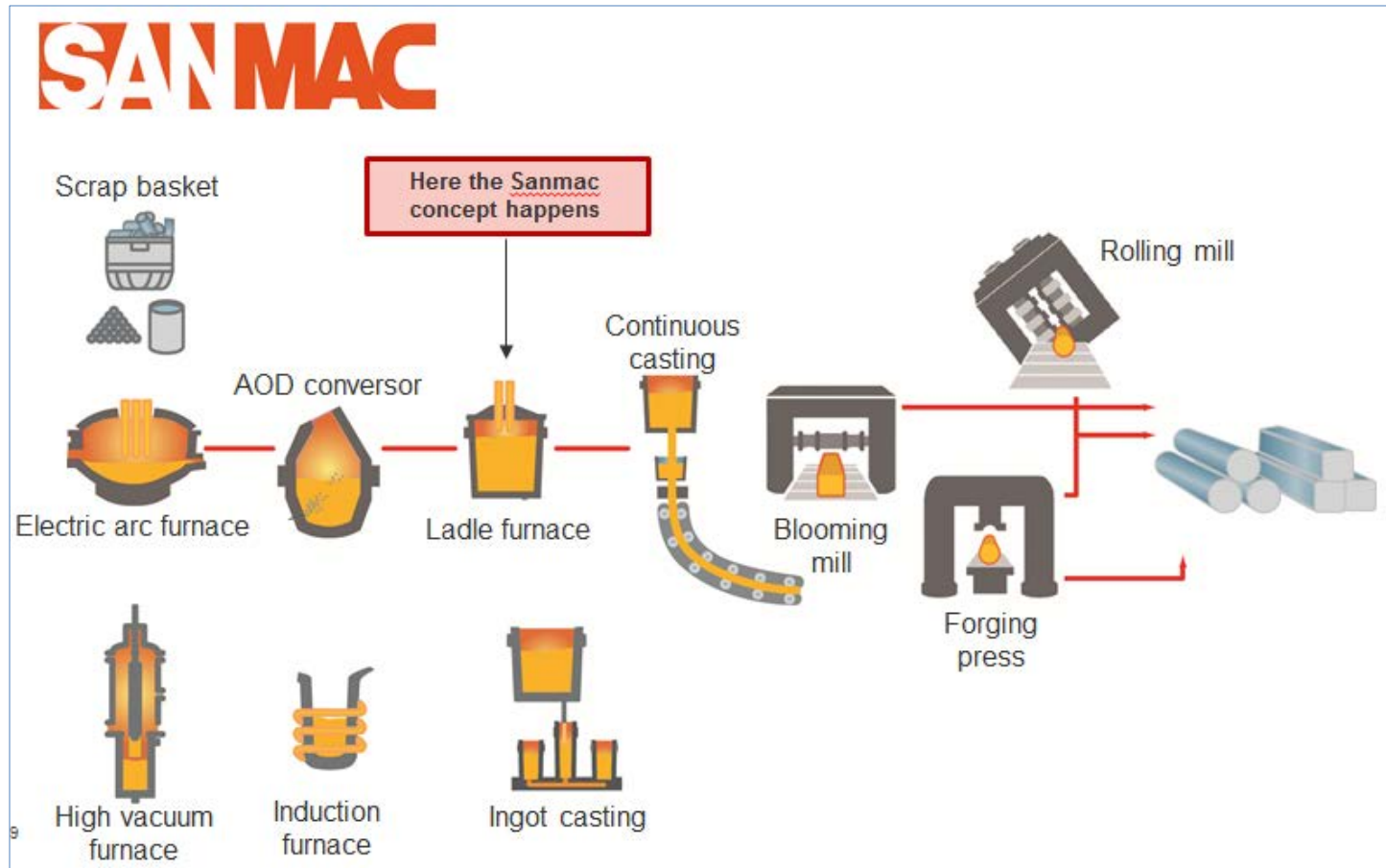
## The Sanmac concept

# SANMAC

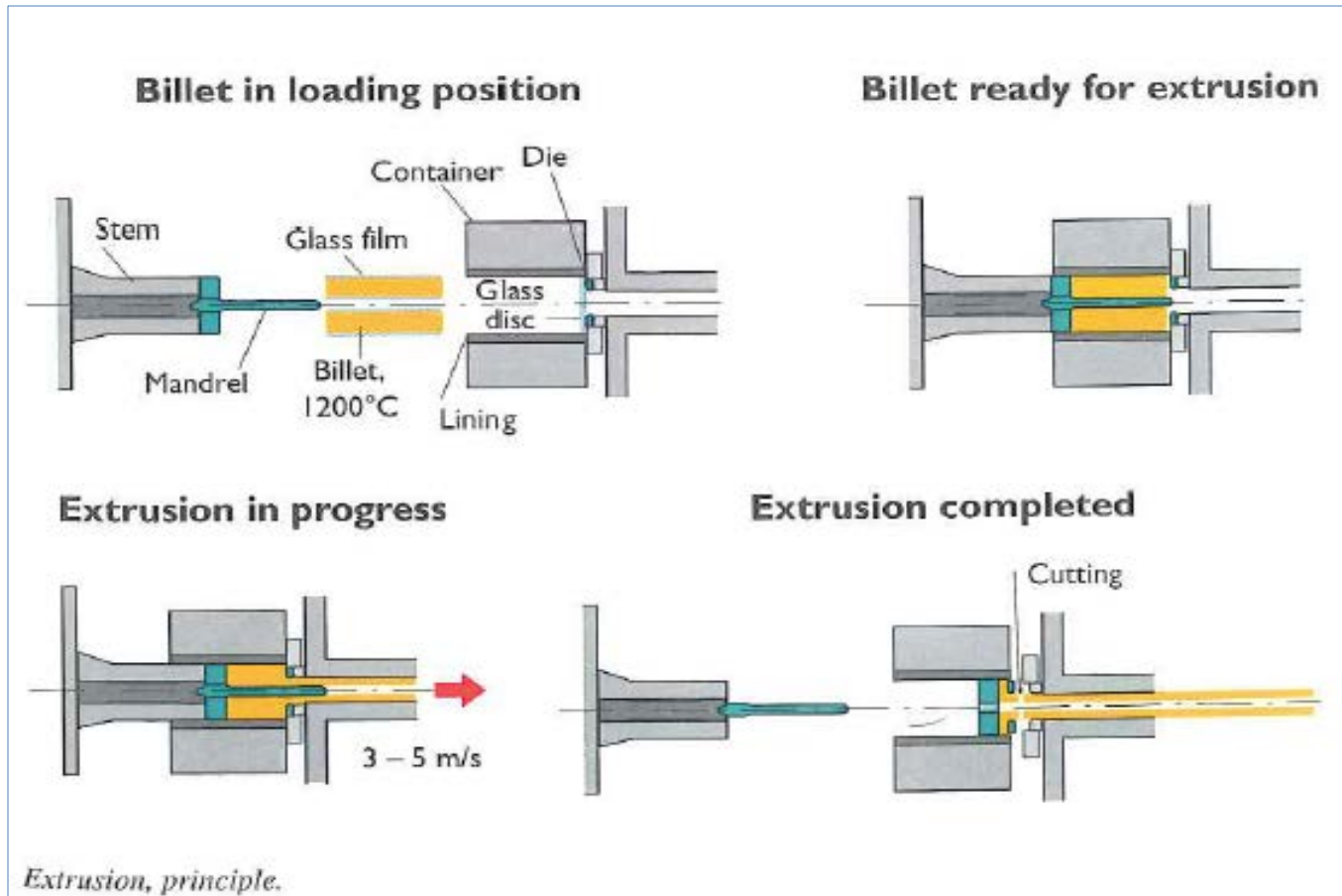
- Excellent machinability
- Consistent quality
- Reduced tool wear
- Increased cutting speeds
- Optimized weldability



# Way of produce at Sandvik Material Technology

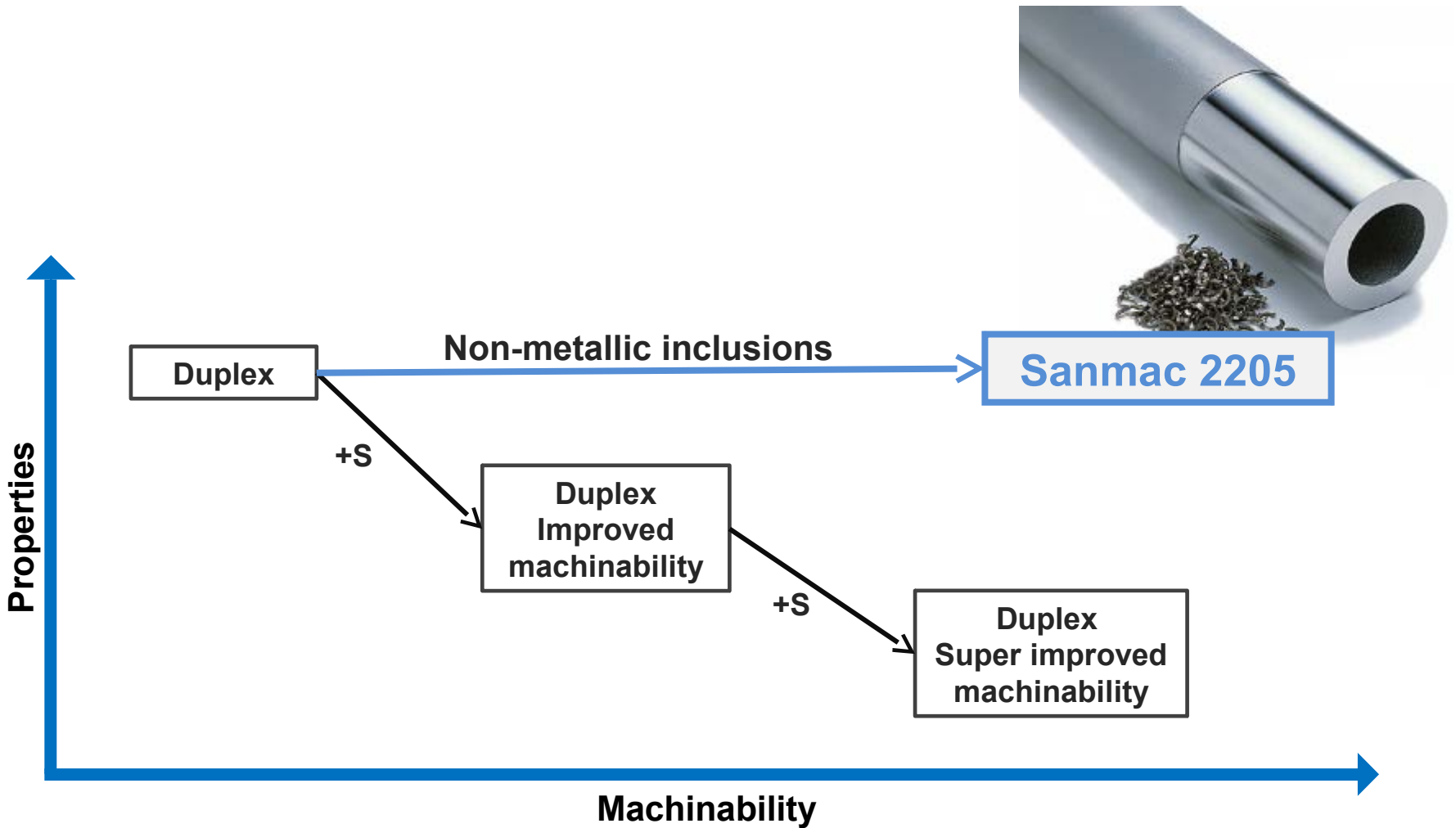






## Duplex hollow bar

- Finishing : Pickling , Straightening , End cutting
- Testing : According to
  - ASTM A790
  - EN 10216-5
  - EN 10294-2
- Norsok approved
  - EN 10297-2
  - M630 MDS D41



# Advantages

## “Duplex hollow bar”

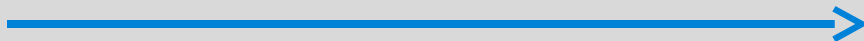
- **Good machinability properties:**
  - Faster machining, shorter production time
  - Less tangled chips due to minimizing boring (internal turning) which is the most demanding operation of all machining operations in duplex stainless steel
- **Easier handling due to lower weight per unmachined component**
  - One of the benefits the machine operator experience apart from the good machinability

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Production cost



Productivity

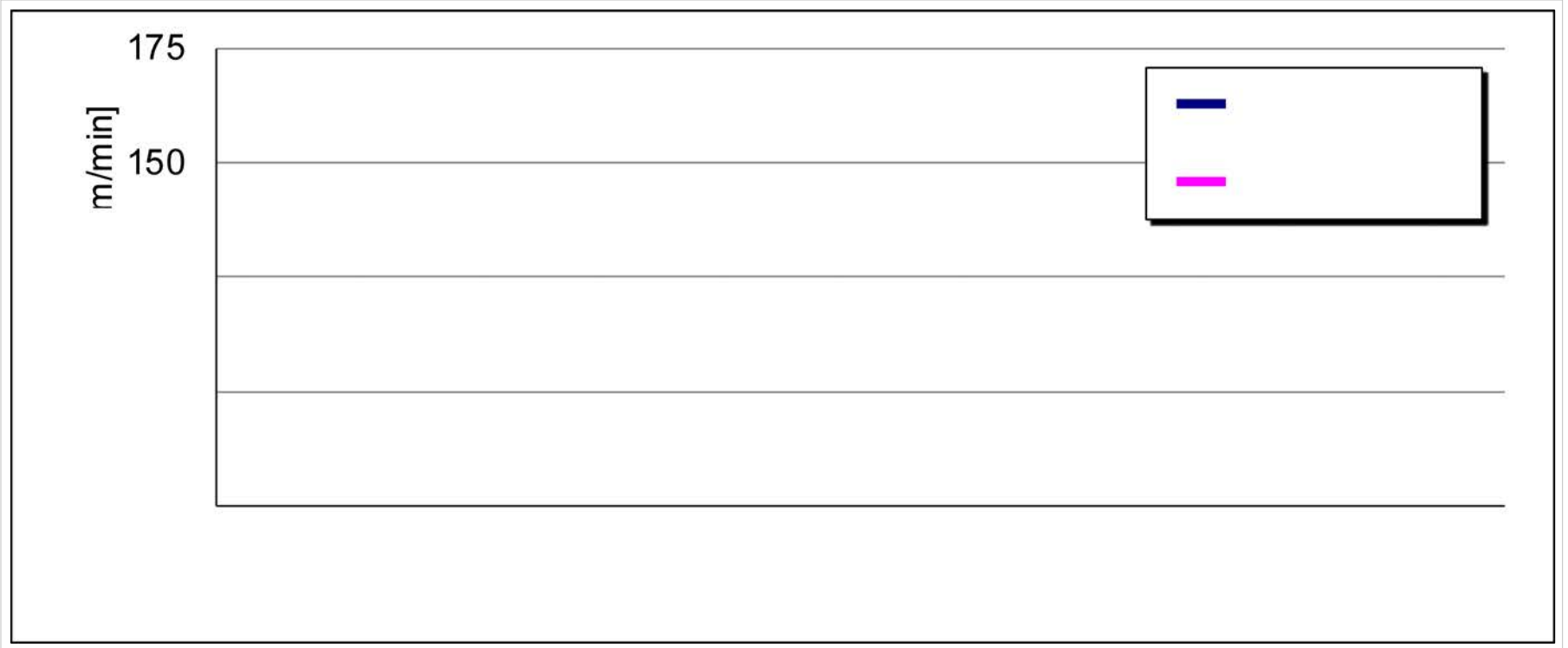


# Disadvantages

## Duplex hollow bar

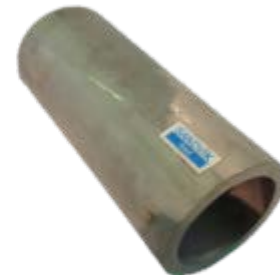
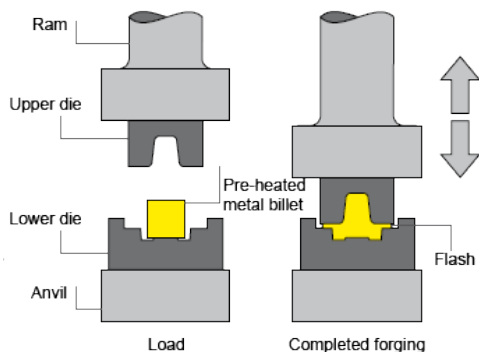
- Mechanical strength could be affected in a negative way  
Pronounced at impact strength testing at low temperatures  
Norsok demands  $-46^{\circ}\text{C}$  ( $-51^{\circ}\text{F}$ ) for impact test  
Sandvik Sanmac 2205 shows well above minimum acceptance values
- Corrosion properties could be affected in a negative way  
PRE values of min 35 together with Norsok approval guarantees corrosion properties, testing according to ASTM G48A, NACE MR 0175
- Weldability properties could be affected in a negative way  
impact strength of HAZ shows no negative effect of the improved  
machinability  
Good bead appearance with and without filler material



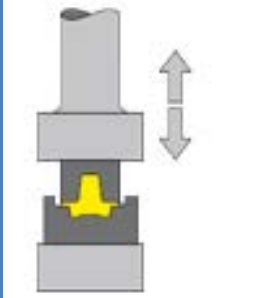

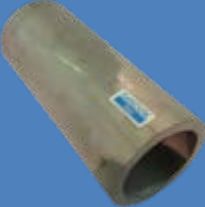


## Consideration about the production costs

- The component that we will manufacture is:  
OD x ID X length: 150 x 80 x 300 mm  
Considering modern tools, workshops, and cost of labour  
Duplex material Sandvik Sanmac 2205 or equivalent  
Set up and running in has been set to 4 hours

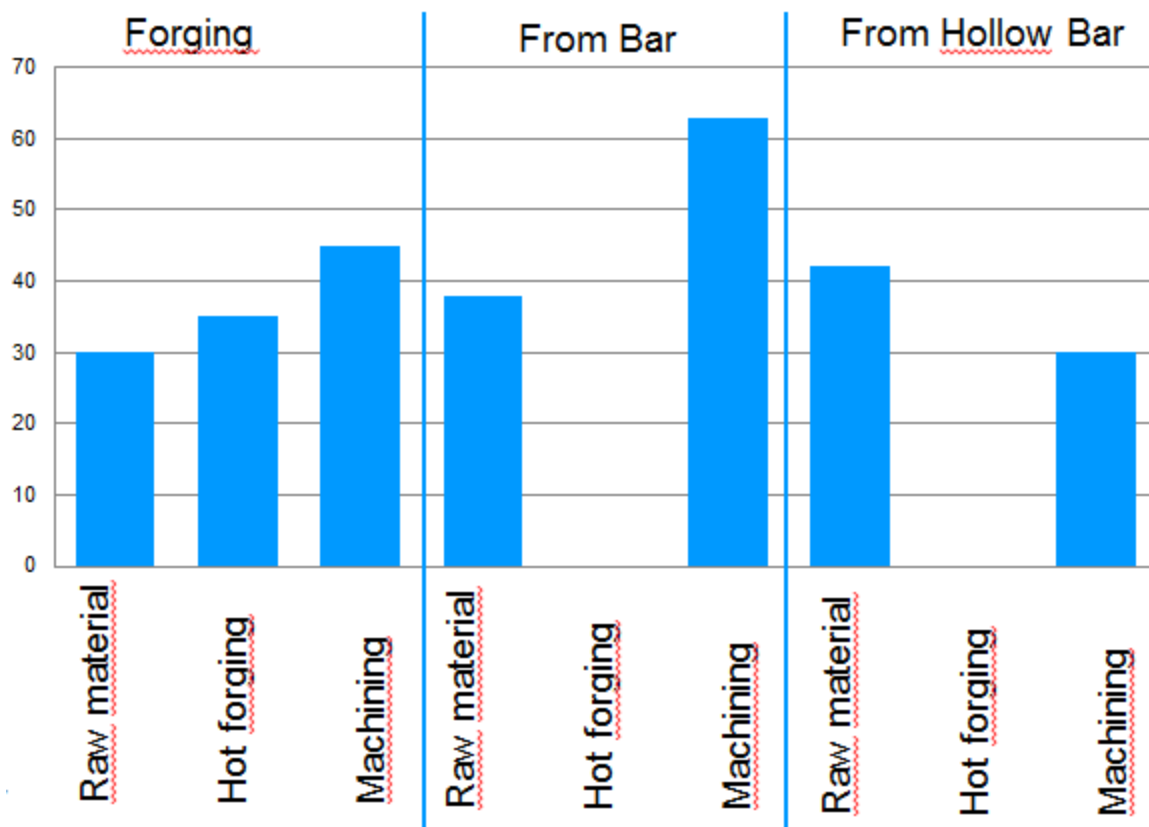


We have tried to calculate the cost of production assuming the production of 100 pieces

<b>Cost/piece</b>  <b>(relatively to bar at 100 pieces)</b>	<b>Forging</b>  	<b>Bar</b>  	<b>Hollow bar</b>  
<b>10 pieces</b>	<b>448</b>	<b>152</b>	<b>123</b>
<b>100 pieces</b>	<b>109</b>	<b>100</b>	<b>71</b>
<b>1000 pieces</b>	<b>74</b>	<b>93</b>	<b>65</b>



100 pieces



# Conclusions

- From the results of the example hollow bar is very competitive from short to long series production.
- Forging is competitive only for long series production.
- Production time can be saved due to shorter production time for forging and hollow bar compared to bar.
- Due to limited internal machining tangled chips can be avoided which even further strengthen the hollow bar competitiveness

## Properties

- Mechanical properties: within the specifications of ASTM A182/A 479/A 790
- Fulfill Norsok MDS 41
- Corrosion properties according to ASTM G48A and NACE MR 0175
- Weldability : no difference between Sandvik sanmac 2205 hollow bar and non machinability improved bar. Good bead appearance with and without filler material

\* La versione di Internet Explorer in uso è obsoleta e a breve non sarà più supportata. [Aggiorna](#)



The thirty minute challenge - Sanmac hollow bar vs solid bar

- Thank you for listening

**SANDVIK MATERIALS TECHNOLOGY**



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