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impact innovation

Increase the acceptance of trace elements in steels (SPÅRA2)

- State-of-the-Art
- Project P2025-03586
- Coordinator Swerim
- Presenter Hans Magnusson

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SPÅRA2 project

- Partners in project: 5 steel producers, 1 end-user, Swerim and Jernkontoret.

- Aim to increase the acceptance of trace elements
  - Increase robustness in future steel production
  - Improve circularity

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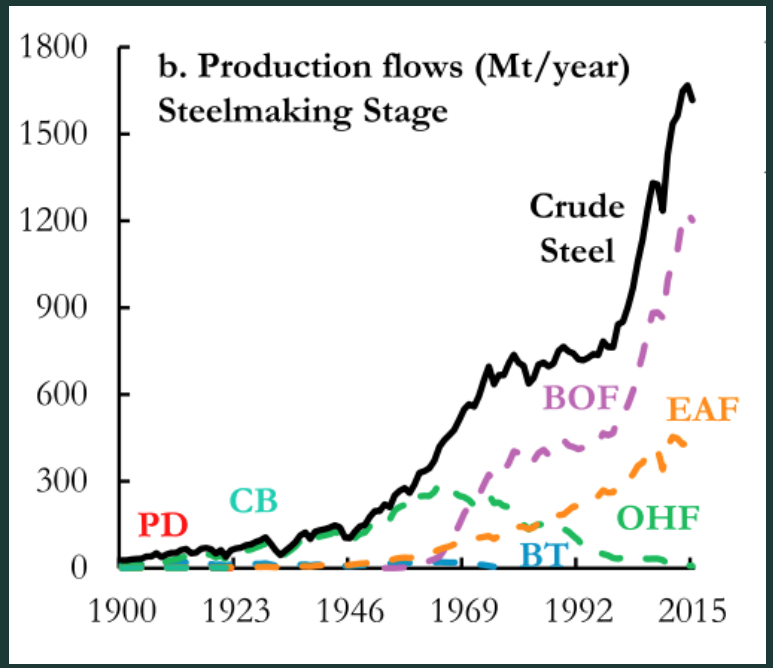
Swedish and international steel production

- BF-BOF and EAF (29% world wide, 33% Sweden).

- BF-BOF has higher CO_2 emissions through carbon-based reduction of iron ore.
- EAF has lower CO_2-emissions in general, mainly related to electricity generation.

- Ageing BF-BOF plants being replaced by EAF as part of the green transition.



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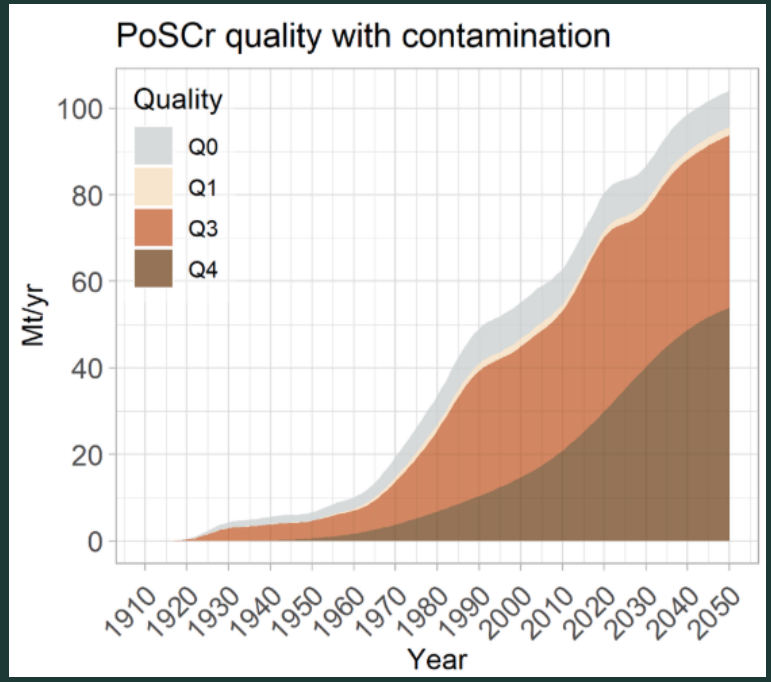
Swedish and international steel production

- With change in metallurgy, the total scrap usage increases.
- Change from new to old scraps.
- Expectations industry is that future steel making will include higher amount of less clean scraps.



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Swedish and international steel production

- Different acceptance of impurities for different steel grades
- Different tonnage for different steel grades

(1) Quality (products average)	Estimated average copper content in products (%)	source	Scrap input rate ($t_{scrap\ inputs}/t_{steel\ output}$)	source	Finished steel products	Scrap consumption by products (Mt; %) Total: 69,05 Mt	
Q3	0.30	(a)	1.10	(f)	Rebars for concrete	12.67	18%
Q2	0.15	(b)	0.61	(g)	Rods and wire rods	11.52	17%
Q3	0.30	(c)	1.15	(h)	Hot rolled bars (e.g. merchant)	9.16	13%
Q2	0.20	(a)	0.73	(h)	Sections (light, heavy, railtrack)	8.84	13%
X	X		0.72	(f)	Casted products (iron and steel)	6.79	10%
X	X		0.80	(g)	Stainless steel products	4.88	7%
Q2	0.15	(b)	0.53	(h)	Hot rolled plate (e.g. Quarto)	4.47	6%
Q1	0.06	(b,c)	0.18	(h)	Hot rolled coils	4.04	6%
Q1	0.05	(b,c)	0.18	(h)	Cold rolled coils	2.46	4%
Q2	0.14	(b)	0.63	(h)	Tube (seamless)	1.84	3%
Q1	0.04	(b,c)	0.09	(h)	Tube (welded)	0.71	1%
Q1	0.04	(d)	0.04	(h)	Galvanized Cold rolled coil	0.65	1%
Q3	0.05	(b,c)	0.11	(h)	Other cold rolled coated	0.49	1%
Q1	0.05	(d)	0.19	(h)	Galvanized Hot rolled coil	0.30	0.4%
Q1	0.04	(e)	0.15	(h)	Electrical sheet	0.13	0.2%
Q1	0.04	(d)	0.11	(h)	Tinplate and tinned products	0.10	0.1%

European Commission (2025)

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Industrial challenges

Example previous project (SPÅRA1)

Testing method	Effect of impurity
Hardness	⬆️ Positive
Tensile testing	⬆️ UTS positive 🟦 Rupture elongation variation seen
Impact testing	🟦 Both positive and negative, depending on heat-treatments
Fatigue testing	🟦 Some variation seen
Bending performance	⬇️ Negative
Surfaces and descaling	⬇️ Negative
Hardenability	⬆️ Positive
Deformation resistance at high temperature	🟦 Very minor effect
Recrystallisation kinetics	🟦 No effect
Prior austenite grain structure	🟦 No effect

Industrial challenges

- Many steel products produced in Sweden are nisched, typically unique product properties and/or complex production routes

- Nickel base alloys – influence P, hot-cracking and corrosion
- Electrical steels – influence P/Cu/Sn, thermomechanical processing and magnetic properties
- Low-alloyed construction steels – Cu/Sn, bending performance and hot-shortness effects, and also surface quality
- Steels for automotive products – Cu/Sn, fatigue properties
- High-speed steels – Cu/Sn/Ce, influence on structure and mechanical properties.

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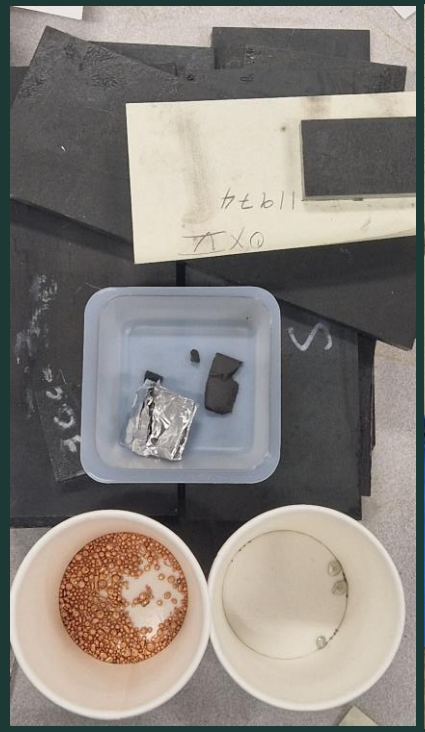

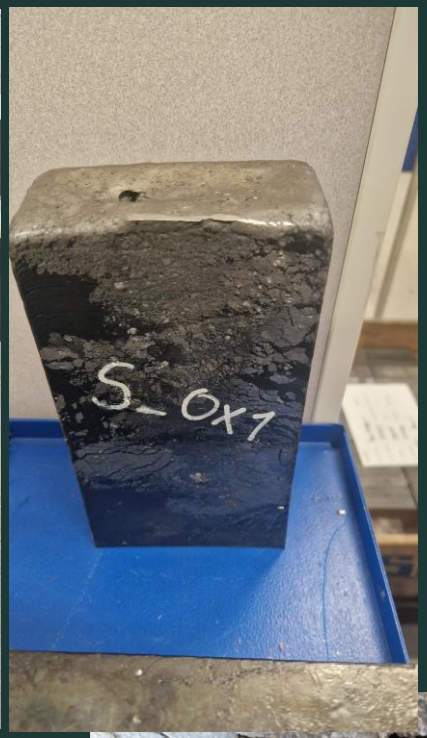

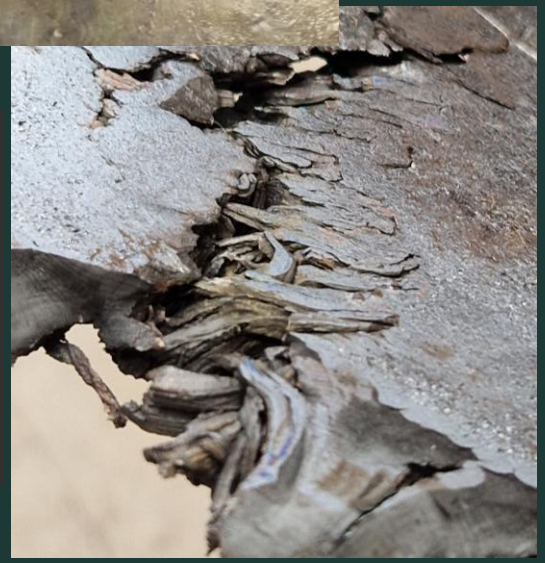

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