

ExtruForm – a New Combined Rolling - Extrusion Process for Wire Rod and Sections

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Abstract



A fundamental analysis of existing processes used for the production of long extruded products, shows that no energy efficient method exist today. RUSAL in collaboration with the Siberian Federal University compared different processes: continuous casting and rolling, direct extrusion and the conform process, in terms of deformation schemes, metal flows and energy consumption. By introducing a combination of rolling and direct extrusion, the Combined Rolling – Extrusion (CRE) process was born. The characteristic deformation of the CRE process is a double-flow metal scheme with the use of active forces of friction. The process has many advantages: high single values of drawing, low energy consumption, good quality control, low CAPEX, small footprint (40 % reduction), fast tooling changes and low maintenance costs. The main disadvantage remains the relatively high extrusion tooling requirements.

All alloys 1xxx, 3xxx, 4xxx, 5xxx, 6xxx and 8xxx could be processed. The CRE process is predominantly used for wire rod production, however sectional shapes are possible, similar to conform process.

The first machine was co-engineered and built by the SMS-Group and is currently operating in one of the cast houses of the Irkutsk Smelter. The unit has a capacity up to 3 tonnes/hour.

Keywords: Continuous casting, Wire rod, Extrusion, Energy reduction, Innovation.

1. Introduction

The origin of the CRE or ExtruRoll process goes back to the collaboration between RUSAL and the Siberian Federal University. The Research at the Laboratories of Metal Forming pioneer new technologies and equipment to produce press-products from non-ferrous metals and alloys. One field of research is to find new ways to produce “long products” starting from liquid Aluminium.

Different processing routes have been established in industry over the years, starting from continuous casting and rolling (CCR); direct extrusion and Conform.

The deformation scheme of each process is different and every process has its pros and cons. Through fundamental analysis the concept of combined rolling and extrusion was developed. The ExtruRoll (CRE) process has a small industrial footprint, a very short lead-time from liquid metal to wire rod product, and a low specific energy consumption per metric ton.

1.1. Process Comparison

Continuous casting and rolling (CCR) is characterized by a single flow metal scheme. Cast bars are deformed into wire rod in several stages. The process is continuous but uses low single values of drawing.

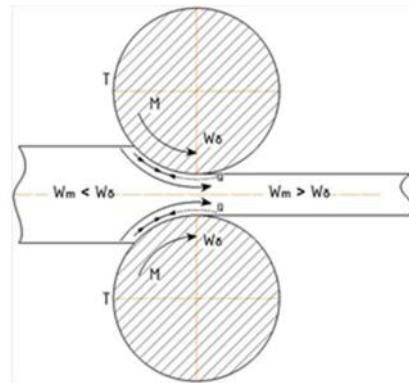


Figure 1. Continuous casting and rolling. Left: equipment and layout. Right: deformation scheme.

Direct extrusion has high single values of drawing but the process is discrete and requires pre-produced billets (casting, inspection, homogenization).

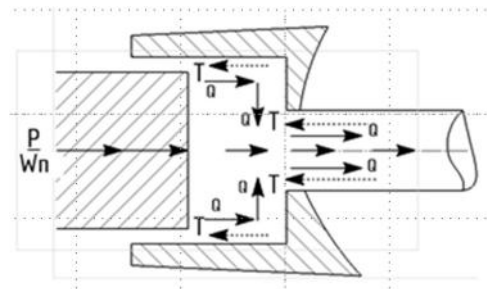


Figure 2. Direct extrusion. Left: equipment. Right: deformation scheme.

Conform uses pre-produced wire rod as input material to create smaller cross-sectional shapes.

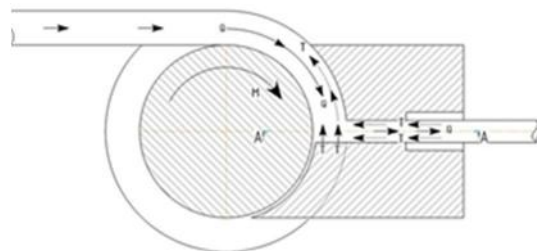


Figure 3. Conform. Left: equipment. Right: deformation scheme.

6. Next Steps for CRE at RUSAL

The CRE pilot line in Irkutsk is both used for production, as well as process development. Focus is on:

1. Equipment improvements and process stability
2. Introduction of irregular shapes
3. Alloy range expansion

RUSAL aims to roll out the technology and build new lines for wire rod production in its smelters.



Figure 13. Casthouse #1 – RUSAL Irkutsk.

7. References

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