Contribution ID: **39** Type: **Oral Presentation**

Next Generation Raw-Material and Process Optimization in Electric Arc Furnace Steelmaking

Monday 11 May 2026 14:30 (20 minutes)

Electric arc furnace (EAF) steel making is increasingly impacted and challenged by volatile scrap markets, scrap quality, energy prices and supply chains. This makes it extremely hard to optimize the operational costs, because of constant daily changes in framework conditions. These dynamics limit the effectiveness of traditional heat-by-heat optimization, particularly when real production orders must be planned across multiple days or weeks. Existing software systems typically optimize either the raw-material selection or alloying strategies for individual heats but lack the capability to perform connected, long-range planning that accounts for stock depletion, future deliveries, hot-heel strategies and intraday energy price variations.

Thus, the demand for sophisticated software solutions that can react to the challenging and fast-changing conditions is extremely high. Recent advances in computational power and artificial intelligence, however, have enabled the development of a more sophisticated solution called "qontrol maps".

This work presents a hybrid metallurgical and machine-learning framework engineered for raw-material characterization, basket charge mixes and heat optimization within a campaign context, where multiple consecutive heats over days or weeks are optimized simultaneously. The model integrates chemical, thermo-kinetic, logistical, economic and environmental constraints across the entire melt-shop route. By coupling real-time inventories, energy and material prices, morphology-based melting kinetics, future deliveries, virtual materials and hot-heel conditions and more, the system identifies optimal material allocations and energy-use strategies that cannot be resolved by traditional optimization approaches.

Real-time scrap, alloying and additive prices, stock levels, future deliveries and scheduled production orders are provided as input. The total number of heats and all operational and logistical constraints (e.g., charging limits, scrap morphology, alloying) are then defined. Based on this information, qontrol maps determines cross-process the cost-optimal practice across the entire campaign. This means that the optimization of raw-materials, charges and heats are linked together and computed simultaneously. Each step in the process: from scrap selection and layering, hot-heel usage, melting behavior, slag formation and casting constraints, contribute to the overall optimization, as decisions in one heat influence the boundary conditions of subsequent heats. Consequently, the entire production route affects the optimal solution, enabling a level of coordinated planning that is not achievable with isolated individual heat optimization.

Industrial applications demonstrate significant reductions in costs, electrical energy demand and CO_2 emissions, together with improved melt-in stability and more efficient use of scrap. The proposed methodology establishes a shift from isolated, single-step optimization toward big-picture predictive campaign optimization for modern EAF operations.

Speaker Country

Austria

Speaker Company/University

qoncept technology GmbH

Primary authors: KERN, Maximilian (qoncept); Mr MICHELIC, Robert (Austria); Dr PIERER, Robert (Austria); Dr MICHELIC, Sebastian (Austria); Dr GRIESSER, Stefan (Austria)

Presenter: KERN, Maximilian (qoncept)

Session Classification: Scrap management and quality improvement

Track Classification: EEC 2 - Process Optimization: EEC 2.B Optimization of raw material usage, including scrap metal and direct reduced iron (DRI)