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MetConZero: Metallurgical Consequences of Zero Carbon Steelmaking

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The primary challenge in steel production today is the reduction of its carbon footprint. To address this, steel producers are increasingly relying on scraps. However, residual elements in post-consumer scrap—such as copper, tin, antimony, nickel, or molybdenum—can degrade steel properties, particularly for advanced high-strength steels. The project MetConZero investigates how these residuals interact in four steel grades—Interstitial Free, Dual Phase, High Strength Low Alloy, and High Carbon—using a broad range of compositions reflecting current and future scrap integration.

The project aims to assess mechanical properties using advanced techniques, including the determination of toughness via the Essential Work of Fracture. Additionally, a novel combinatorial method will be employed to produce samples with chemical gradients to study residuals' effects on recrystallization. Also, solid solution, precipitation, and segregation effects will be characterized using state-of-the-art techniques. The collected dataset will be analyzed with machine learning methods to identify and model key influences of these residuals.

Anticipated outcomes include practical guidelines for managing residuals in scrap-based steelmaking, alongside integration into tools like StripCam and ToughSteel. These will optimize scrap utilization without compromising quality, supporting carbon-neutral steel production aligned with European decarbonization targets.

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