



# SERTIFICATE OF TRAINING

This is to certificate that:

**Boyko Igor**

has completed the training course on sustainable steel production,  
has successfully passed the test on course

Training was completed on  
February 11, 2022

«TECHNICAL UNIVERSITY «METINVEST POLYTECHNIC», **Rector Prof. Dr O. Povazhnyi**

K1-MET GmbH, Area Manager Raw Materials and Recycling & Metallurgical Processes, **J. Rieger**

K1-MET GmbH, Montanuniversitaet Leoben, Chair of Ferrous Metallurgy **Prof. Dr J. Schenk**

Two handwritten signatures in blue ink. The top signature is "J. Rieger" and the bottom signature is "J. Schenk".

Course	Course Type	Duration	Short description
Residues from metallurgical processes	Lecture	1.5 h	Types and characterisation of by-products (dust, sludges and slags) and scrap
Metal recycling	Lecture	1.5 h	Processing and cleaning of scrap, dust, and slags
			Recycling processes to recover ferrous and nonferrous metals (e.g., zinc)
			Definition and discussion of product qualities and markets
Seminar circular economy in metallurgy	Seminar / workshop	3.0 h	In the seminar, the contents of the lecture are applied to practical problems and questions of MIP. The seminar topic will be defined together with MIP in advance
Plant and process safety	Lecture	1.5 h	Legal foundations
			Definition of risk and risk assessment
			Basics of fire and explosion prevention
			Methods for hazard analysis (e.g., HAZOP), safety instrumented systems (SIS)
Occupational safety issues in residue's processing operation	Lecture	1.5 h	Industrial processing and plant engineering
			Mass and energy conversion
			Heat-transfer in high-temperature processes
			Regulation control
Seminar occupational safety during residue processing	Seminar / workshop	3.0 h	Seminar topic will be defined together with MIP in advance
Process pathways to low CO <sub>2</sub> steelmaking	Lecture	1.5 h	Reduce CO <sub>2</sub> emission of existing iron and steelmaking sites
			Production of steel without greenhouse gas (CO <sub>2</sub> ) emission
Use of hydrogen in the steel industry	Lecture	1.5 h	Use of H <sub>2</sub> in current process routes for steelmaking
			H <sub>2</sub> -based direct reduction processes
			Smelting reduction with H <sub>2</sub> plasma
			Transformation of the steel industry from C-Based to H-based processes
Seminar Carbon Direct Avoidance for low carbon steelmaking	Seminar / workshop	3.0 h	Seminar topic will be defined together with MIP in advance
Carbon Capture and Utilization technologies for smart carbon usage	Lecture	1.5 h	Capturing and utilising of CO/CO <sub>2</sub> from process industries with one focus on the steel sector
CO <sub>2</sub> as raw material for sector coupling	Lecture	1.5 h	Examples of interconnecting industrial processes to reduce CO <sub>2</sub> emissions and store renewable energy
			Circular economy solutions by having one industrial sector using CO <sub>2</sub> from another sector
Seminar Smart Carbon Usage (Carbon valorisation)	Seminar / workshop	3.0 h	Seminar topic will be defined together with MIP in advance.