Tampereen yliopisto

# World Foundry Congress – ajankohtaisia teemoja



# World Foundry Congress

Joka toinen vuosi järjestettävä, suurin valimoalan tieteellinen tapahtuma

**2026 Istanbul**

**2028 Mexico City**



# Numeroina

- 200+ esitystä
- 70+ posteria
- 1100+ osallistujaa






# Tekoäly valimoteollisuudessa

Mitä on tutkittu, mihin keskitytään maailmalla?
Kokoavia tutkimusteemoja konferenssista?

# Tulevaisuuden metalliteollisuus?

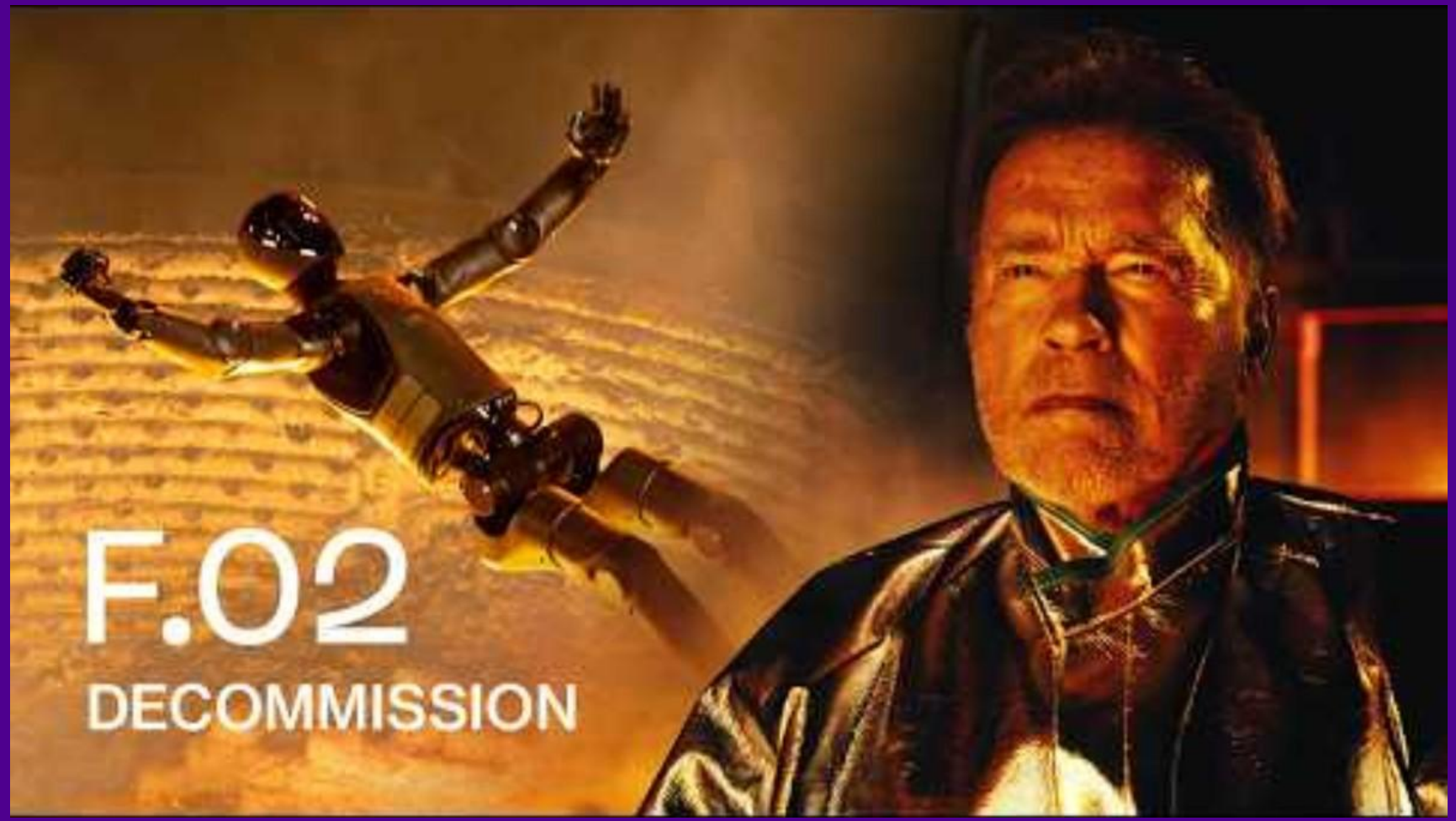



Figure AI – F.02 Decommission – toteutettu OVAKO Imatra

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# Congress Topic Areas

42 esitystä

Advancements in Cast Iron and Cast Steel Technologies

Advancements in Non-Ferrous Casting: Materials and Processes

52 esitystä

Die Casting: Technologies, Challenges, and Future Directions

Precision Casting: Achievements and Emerging Technologies

22 esitystä

Molding Materials, Ceramics, and Refractories: Science and Applications

Lean and Agile Manufacturing in Foundries: Optimizing Processes for Efficiency and Cost Reduction

12 esitystä

AI and Machine Learning in Foundry Process Optimization

Intelligent Digital Casting and Materials Genome Engineering

8 esitystä

Surface Engineering and Heat Treatment of Castings

Additive Manufacturing in Foundries: Materials and Process Innovations

10 esitystä

Fabrication and Machining of Cast Materials: Challenges and Advances

Cast Metal Matrix Composites: Design, Processing, and Applications

15 esitystä

Smart Foundries: Advancing Efficiency, Productivity, and Innovation

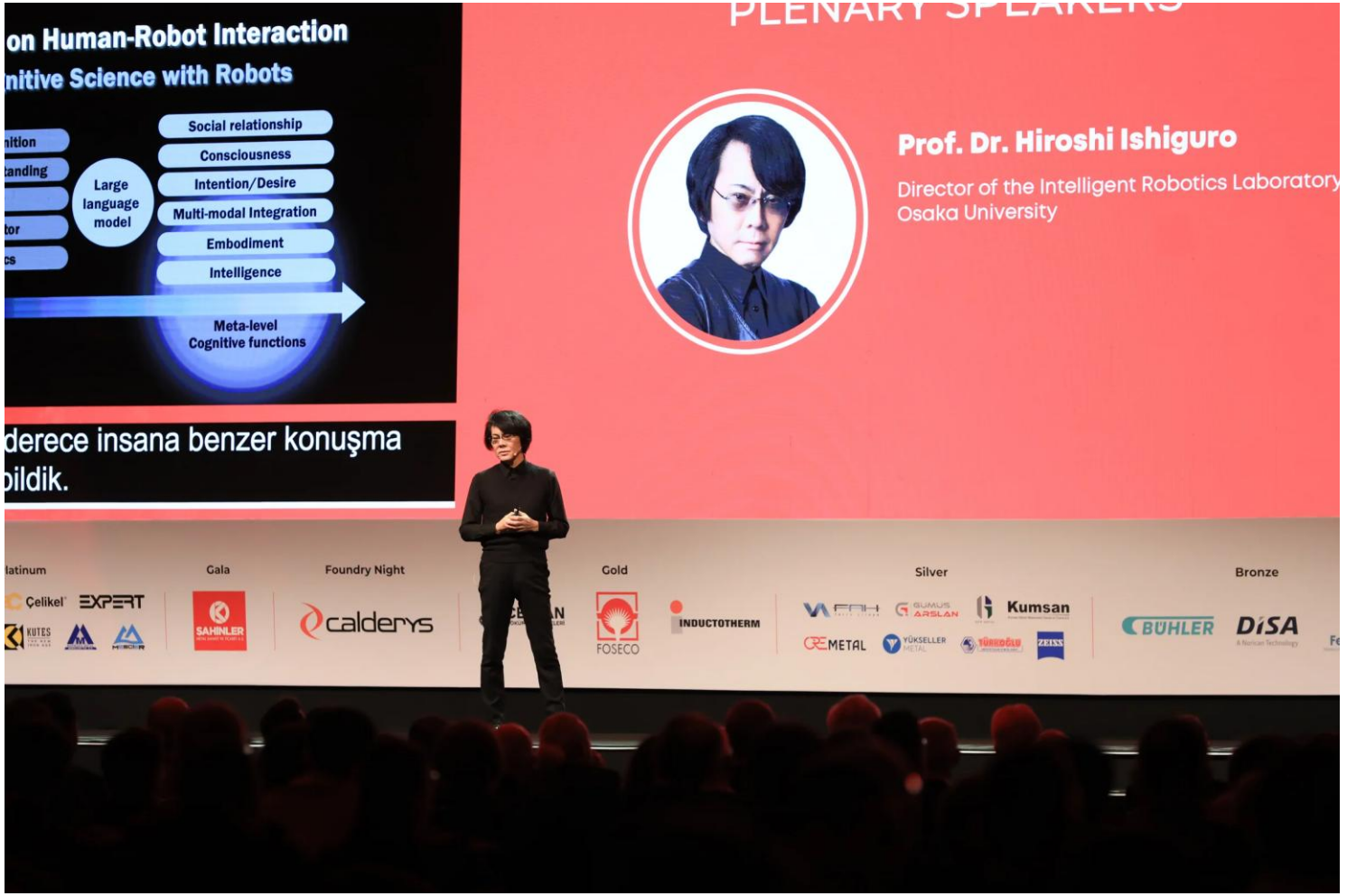
The ESG Imperative: CBAM, Circular Economy, and the Regulatory Future of Foundries

8 esitystä

# Cybernetic Avatars and Intelligent Robots

**”Teleoperated avatars and computer generated agents”**

- Etäkäyttö, etätyöt ja puoliautonomiset avatarit
- Autonomiset agentit
- Työvoiman saatavuus ja työturvallisuus



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# AI and Machine Learning in Foundry Process Optimization

**Deep Learning-Based Segmentation of Graphite Morphology** and Matrix Phases in Cast Iron

- Metallografiaa ja laaduntarkastusta

Intelligence Empowers Precision Casting: **Intelligent Robots** in the Whole Process of Precision Casting

- Robotiikkaa

Research and Application of **Foundry Character Recognition** Algorithm Based on Deep Learning

- Valujen merkintöjen tunnistaminen

Application of AI Vision Technology in the **Intelligent Inspection and Grinding of Castings**

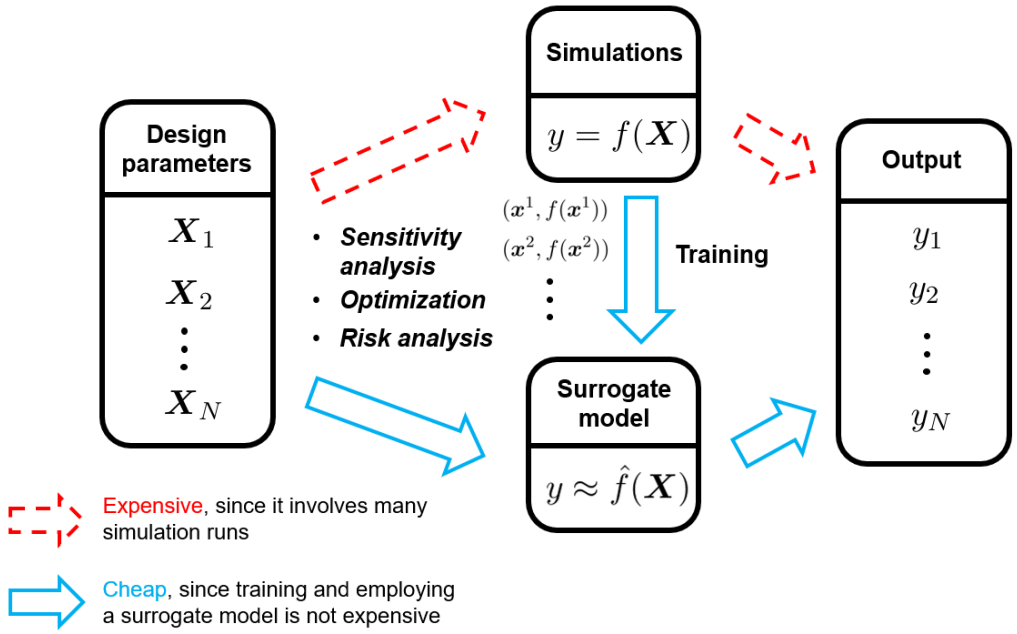
- Valujen jälkikäsittely

Investigation of **Data Processing Method for Green Sand Characteristics** Using Machine Learning

- Hiekkamuottien laadunhallintaa



# AI and Machine Learning in Foundry Process Optimization




**3D Topography Reconstruction Algorithm** for Internal Defects in Aluminum Alloy Castings Based on Multi-Angle X-ray Images

A **Casting Temperature Field Prediction** Method Based on Multi-head U-net

- Perinteisen jäähtymissimulaation korvaaminen ML/AI-tekniikoilla

**Heat Transfer Coefficient** Between Zinc Alloy for Press Molding Dies and Sand Mold in Open Casting

Integrated Analysis of Manufacturing Data for **Predicting Electric Furnace Power Consumption** in the Casting Melting Process

# Posteriesitykset konferenssissa - AI

## AI and Machine Learning in Foundry Process Optimization

Machine Learning-Based Prediction of Solidification Defects Using Simulation-Derived Datasets
Umar Siddique - Finland

Research on AI Process Control and Safety Early Warning System for Vacuum Suspension Melting Furnace Based on Big Data Driven
LiWanQing LiWanQing - China

Prediction of Solidification in Investment Casting and Adaptive Hot-Spot Field Analysis Based on the Physics-Informed Kolmogorov–Arnold Network (PIKAN)
Lechuan Li - China

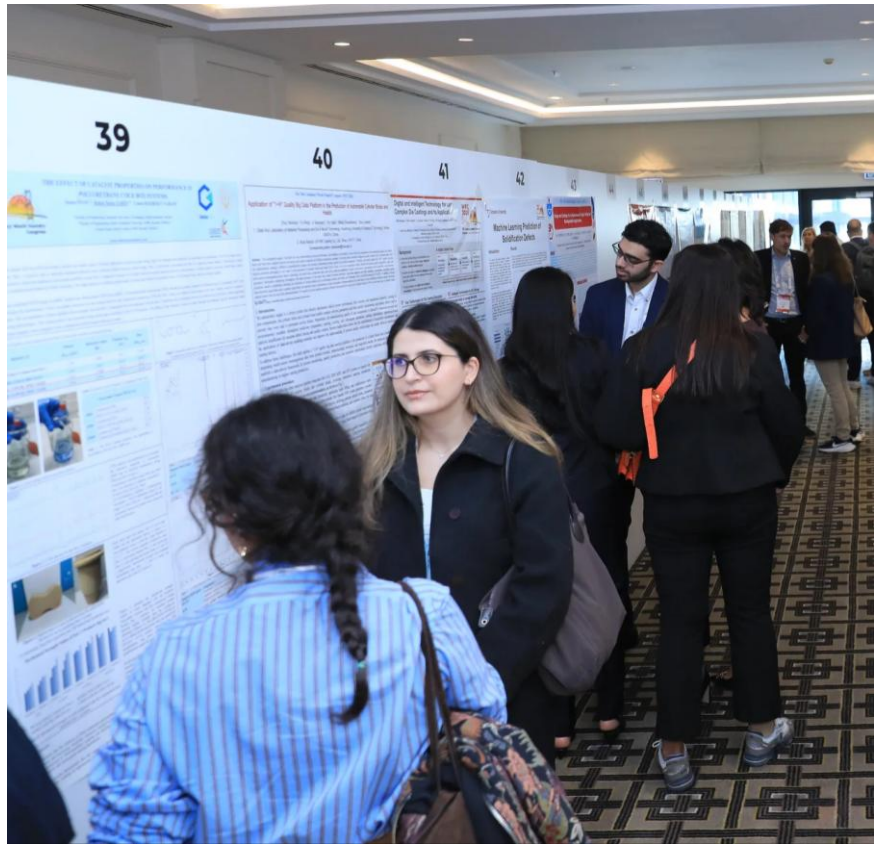
Application of "1+N" Quality Big Data Platform in the Production of Automobile Cylinder Blocks and Heads
Wenhao Zhou - China

Digital and Intelligent Technology for Large Complex Die Castings and Its Application
Jianxin Zhou - China

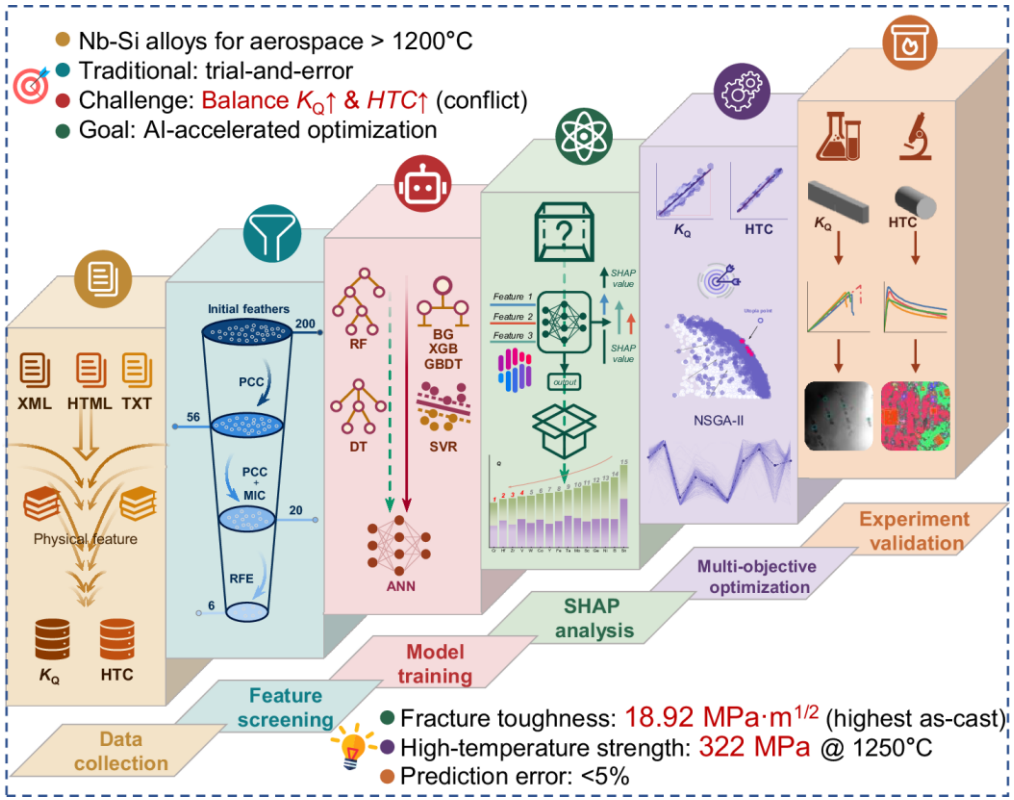
Prediction Model of Sand Casting Defects Based on Domain Knowledge Augmentation and Imbalanced Learning
Xinxiang Yang - China

Time-Series Prediction of Mold Temperature Field and Multi-Regional Defect Collaborative Optimization in Low-Pressure Die Casting of Aluminum Alloy Wheels
Yu Peng - China

An Application Framework of Explainable Artificial Intelligence for Casting Process Optimization
Danian Cao - China



# AI in materials development




An Integrated Framework For Designing The Advanced Ni-Based Single-Crystal Superalloys By Integrating High-Throughput Experiments And Machine Learning
Qiang Feng, University of Science and Technology Beijing, China

The Role of AI in High-Nb TiAl Alloys: From Microstructural Evolution to Property Enhancement
Hongze Fang, Harbin Institute of Technology, China

A Combined CALPHAD and Machine Learning Approach to Designing Precision-Cast Ti2AlNb-Based Alloys
Jun WANG, Northwestern Polytechnical University, China

Multi-objective Design of High-Performance Nb-Si Based Alloys via Interpretable Machine Learning
Wei Chen, Huazhong University of Science and Technology, China

**Plenary session: Prof. Ruirun Chen – AI in Titanium alloy development**

# Smart Foundries

“When Metal Thinks: From Isolated Models to Collaborative Intelligence”

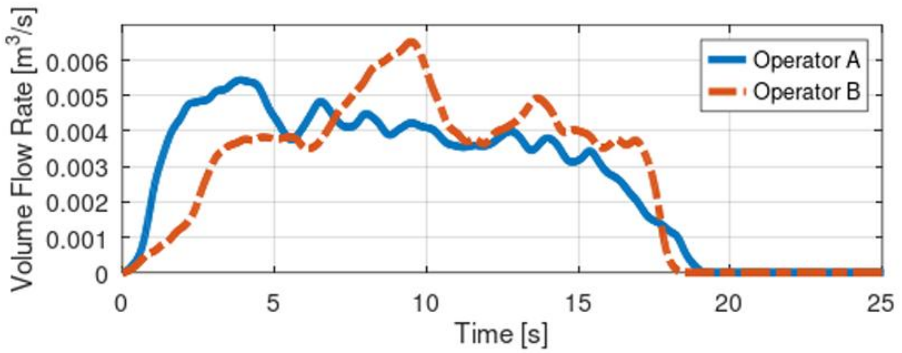
Digital Twin-Based **Visualization of Pouring Flow Pattern** for Evaluation of Manual Pouring Operation

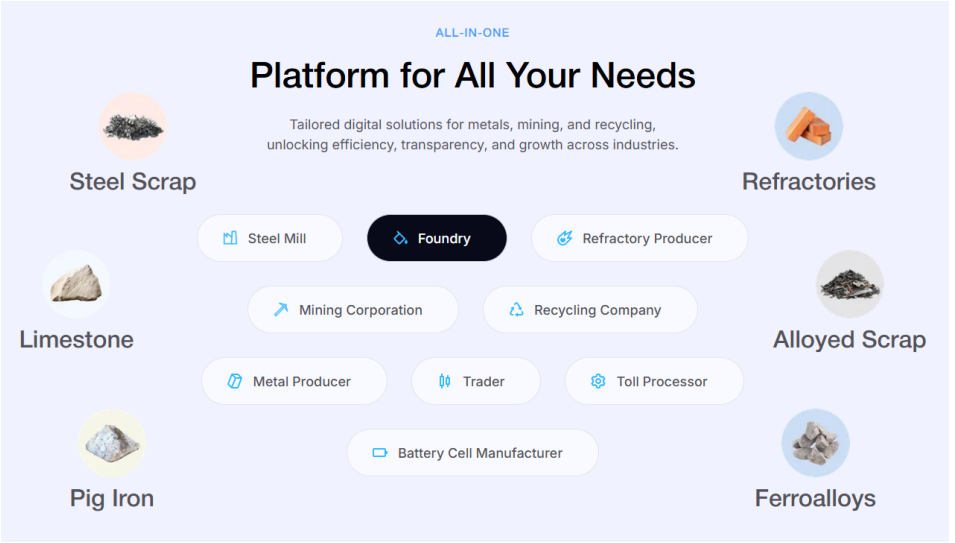
- Uusien valajien koulutus ja vastaavuus simulointeihin

Rethinking **Raw Material Procurement** in Foundries

- Tekoälyn käyttö raaka-aineiden hankintaan

Creating Smart Hazards & Risks Management Culture in Foundries via AI



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# Young Researchers Competition




- 19 osallistujaa
- 10 kutsuttua

Voittaja koneoppimisen käytöstä prosessioptimointiin

1st Place



**Qihang Yang**
Tsinghua University
CHINA

Optimizing investment casting processes for large complex thin-walled titanium alloys using small-data machine learning method

2nd Place



**Reo Fuse**
University of Yamanashi
JAPAN

Digital Twin-Based Visualization of Pouring Flow Pattern for Evaluation of Manual Pouring Operation

3rd Place



**Elena Mingotti**
University of Brescia
ITALY

Structural Castings Made of Recycled Alloys: Optimization of Performance

# Loppuajatuksia tapahtumasta

Pääosin perinteistä **materiaalikehitystä ja metallurgiaa**

**Yllättävän vähän AI – teemaa** huomioon ottaen lähivuodet

…kuitenkin sisältäen mielenkiintoisia kehityssuuntia

- Olemassa olevan datan käyttö kehityksessä ja laadunhallinnassa?
- ”Sisäisen tiedon” siirtäminen ja työvoima

