

AI Metallurgy

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Abstract: This paper presents the development and implementation of an artificial intelligence-driven metallurgical property prediction system that leverages machine learning algorithms to predict mechanical, thermal, and electrical properties of metal alloys based on their chemical composition. The system addresses the critical need for rapid and accurate property prediction in materials science, enabling accelerated alloy design and optimization processes. Our web-based application utilizes ensemble machine learning models trained on comprehensive metallurgical datasets to predict key properties including yield strength, tensile strength, hardness, thermal conductivity, electrical conductivity, and corrosion resistance. The system demonstrates significant potential for reducing experimental costs and time-to-market for new alloy development. Results show prediction accuracies exceeding 92% for mechanical properties and 88% for thermal/electrical properties, with processing times under 0.2 seconds per prediction.

Keywords: Artificial Intelligence, Machine Learning, Metallurgy, Property Prediction, Alloy Design, Materials Science, Computational Materials Science