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LinkedIn Profile

Professional Summary

Innovative and enthusiastic multidisciplinary scientist with extensive expertise in materials science and metallurgy. Adept at alloy design and production technologies, with a strong track record of research and teaching experience. **Recognized as the top researcher** in the field by Iran University of Science and Technology. Eager to contribute to cutting-edge research and tackle new challenges, particularly in the area of **Alloy Design, Metal Casting, Additive Manufacturing and Oxidation**.

Education

Ph.D. in Materials Science and Metallurgy Iran University of Science and Technology, Tehran, Iran (2022)

Master of Science in Materials Science and Metallurgy Iran University of Science and Technology, Tehran, Iran (2017)

Bachelor of Science in Industrial Metallurgy Tabriz University, Tabriz, Iran (2014)

Research Experience

Microstructural and Mechanical Analysis of Thin Wall Printed from Plain Carbon Steel Using GMAW Robotic Additive Manufacturing Researcher, Iran University of Science and Technology, Tehran, Iran (2024)

- *Printed a thin wall using GMAW robotic additive manufacturing with WAAM wire arc on a St37 substrate.*
- *Microstructural studies showed recrystallization in bottom layers and secondary recrystallization forming fine ferrite grains with inter-granular spherical cementite.*

- *Observed a dendritic structure with bainite and martensite in the upper part (Z-direction), leading to higher hardness and compressive strength.*
- *Determined highest strain in X-direction at the bottom due to recrystallization and regular ferrite grains with fine pearlite boundaries.*

Interface Study of Aluminum-Brass Bimetallic Hollow Cylinders Produced by Vertical Centrifugal Casting Researcher, Iran University of Science and Technology, Tehran, Iran (2023-2024)

- *Produced aluminum-brass bimetallic hollow cylinders using the vertical centrifugal casting process, with aluminum melt cast into preheated brass hollow cylinders at various temperatures (100-400°C) and rotation speeds (800, 1600, 2000 rpm).*
- *Conducted X-ray diffraction analysis, optical microscopy, scanning electron microscopy, and energy-dispersive X-ray spectroscopy to study the interface.*
- *Identified three discernible interface layers: chill zone (Al2Cu5Zn4 + Al3Cu3Zn), platelet precipitate zone (Al2Cu precipitates in α-Al matrix), and anomalous eutectic grains (α-Al/Al3Cu) near the aluminum side.*
- *Performed mechanical tests, including Brinell, Vickers, and compression tests, to evaluate the interface's mechanical properties.*
- *Found that interface adhesion decreased with increasing interface thickness.*
- *Fractography revealed flat faces (Al2Cu precipitates) and deep depressions associated with cup-shaped dimples (α-Al/Al3Cu eutectic).*

Characterization of Oxides on the Surface of Mg-Al, Zn-Al & Al-Cu Alloys Co-Supervisor, Iran University of Science and Technology, Tehran, Iran (2020-2022)

- *Investigated the dynamic oxidation of Al and Mg alloys using the newly devised oxide/metal/oxide (OMO) sandwich method to physically simulate bifilm formation in molten metals. Characterized dynamically formed oxide films by introducing air bubbles into the melt to form sandwich samples.*
- *Utilized scanning electron microscopy (SEM) and energy-dispersive X-ray spectroscopy (EDS) for analysis.*
- *Found that the thickness of oxide films on pure molten magnesium in dynamic conditions ranged from 200 to 800 nm, with features such as folds, wrinkles, and cracks observed.*
- *Determined that oxidation products of Mg-Al alloys mainly consist of MgO and $MgAl_2O_4$ compounds, with varying film thicknesses from 0.43 to 16.7 mm.*
- *Observed that higher Zn content in Al-Zn alloys led to more cracks and a reduction in oxide film thickness, with values estimated between 95-1070 nm.*
- *Concluded that the presence of spinel phase at the interface reduced the thickness of oxide films, as confirmed by thermodynamic calculations and EDS results.*

Mechanism of Short-Time Oxide Formation on the Surface of Al-Mg Alloys with the Addition of Be and Ca Traces in Dynamic Conditions Researcher, Iran University of Science and Technology, Tehran, Iran (2018-2022)

- *Investigated short-time oxidation of Al-Mg melts in turbulent conditions to understand double-layer oxide defects.*
- *Found that Be and Ca additions reduced oxide film thickness by 12-70% depending on Mg content.*
- *Be enhanced the oxide/oxide bond quality, forming a single strong oxide film in some regions.*
- *Chemical and structural analyses (HRTEM, XRD, XPS) revealed initial MgO layer formation, with BeO and $MgAl_2O_4$ layers forming in Be-containing samples, and $CaMg_2Al_{16}O_{27}$ and $CaAl_2O_4$ compounds forming in Ca-containing samples.*
- *Observed that as the MgO layer thickened, secondary $CaMg_2Al_{16}O_{27}$ could form, along with Calcium Aluminates such as $CaAl_2O_4$, which deformed and tore up the oxide film*.

Visiting Researcher Korea Institute of Industrial Technology, South Korea (November 2019 - April 2020)

- *Characterized the short-time oxide films on the surface of Al-Mg-Be-Ca melts.*
- *Conducted surface analysis using advanced characterization techniques.*

Modification of Melt Temperature & Solid/Metal Ratio in Al/Brass, Al/Cast Iron & Al/Al Alloy Compound Casting Researcher, Iran University of Science and Technology, Tehran, Iran (2015-2017)

- *Analyzed the microstructure and mechanical properties of the resulting compounds.*
- *X-ray diffraction (XRD) and scanning electron microscopy (SEM) studies of Al/Brass Samples identified various layers, including CuZn, Al_4Cu_3Zn, Al_2Cu, α-Al/Al_2Cu eutectics, and Al dendrites near the solidified aluminum melt.*
- *The formation of Al_2Cu and Al_4Cu_3Zn layers prevented solid solutions from being saturated by copper.*
- *Microscopic observations revealed the formation of a reaction layer at the interface composed of Fe_2Al_5 intermetallic for Al/C.I. samples.*
- *Suggested a mechanism for the nucleation and growth of the intermetallic layer and the encapsulation of flake graphite at the interface.*

Corrosion Behavior of Plasma Nitrided AL2024 in Various Atmospheres Research Assistant, Tabriz University, Tabriz, Iran (2013-2014)

- *Investigated the corrosion behavior of plasma nitrided Al2024 in different atmospheres.*
- *Coated Al2024 samples with Active Screen Plasma at 400, 450, and 500°C for 10 hours in a 25% H2-75% N2 atmosphere.*
- *Found that a uniform AlN layer formed on the surface of all samples, with nitride particles at lower temperatures and a uniform layer at higher temperatures.*
- *Confirmed the formation of AlN using scanning electron microscopy (SEM) and X-ray diffraction (XRD) analysis.*

- *Conducted polarization tests in 3.5% NaCl solution, showing improved corrosion resistance after both active-screen and conventional plasma nitriding.*
- *Determined that plasma nitriding significantly enhances the corrosion resistance of Al2024 in sulfuric acid environments.*

Publications

1. Microstructure and Mechanical Properties of the Interface of Aluminum-Brass Bimetals Produced via Vertical Centrifugal Casting (VCC), International Journal of Metalcasting, 2024
2. Characteristic Investigation of the As-Received Samples: Nano-Oxides in Al–5Mg–Be Melt, International Journal of Metalcasting, 2023
3. Investigation of the Microstructure and Mechanical Behavior of Plain Carbon Steel Produced Via Wire Arc Additive Manufacturing (WAAM), Metallography, Microstructure, and Analysis, 2023
4. Characteristics of Dynamically Formed Oxide Films in Al–Zn Melt, International Journal of Metalcasting, 2021
5. Short-Time Oxidation of Al–Mg in Dynamic Conditions, Oxidation of Metals, 2020
6. On the Dynamically Formed Oxide Films in Molten Mg, Journal of Magnesium and Alloys, 2020
7. A New Insight to Dynamic Oxidation of Molten Metals by the Parametric Study of Oxide/Metal/Oxide Sandwich Formation, International Journal of Metalcasting, 2020
8. Surface Oxidation Study of Molten Mg–Al Alloys by Oxide/Metal/Oxide Sandwich Method, Journal of Magnesium and Alloys, 2022
9. Study of Al/Cast Iron Interface and Graphite Behavior, Journal of Mining and Metallurgy B: Metallurgy, 2017
10. On the Interfacial Characteristics of Compound Cast Al/Brass Bimetals, International Journal of Metalcasting, 2017

Teaching Experience

Thermodynamics of Materials *Iran Steel Association, Kerman, Iran (October 2023 - November 2023)*

Thermodynamics for Surface Engineering *OTC, Tehran, Iran (September 2022 - October 2022)*

Advanced Characterization Methods for Surface Engineering *OTC, Tehran, Iran (September 2022 - October 2022)*

Phase Diagram and Equilibrium Calculations via FactSage *Iran Mavad, Tehran, Iran (June 2021 - September 2021)*

Advanced Casting Methods *Iran University of Science and Technology, Tehran, Iran (September 2021 - December 2021)*

COMSOL Multiphysics for Metallurgy Engineers *Iran University of Science and Technology, Tehran, Iran (January 2018 - April 2018)*

Casting Technology *Iran Education Department, Technical School, Tehran, Iran (June 2013 - March 2018)*

Awards and Honors

Top Researcher in the Field of Materials Science and Metallurgy *Iran University of Science and Technology, 2021*

- **Recognized** for exceptional contributions and achievements in the field of materials science and metallurgy.

Professional Affiliations

- **Iran Educational Department**: **Technical Instructor**, 2011-2017
- **Iran University of Science and Technology**: **Research Assistant**, 2017-2022
- **Advance Materials Technology Lab**: **Researcher**, 2022-Present

Skills

- COMSOL Multiphysics
- FactSage
- Origin Lab
- Xpert High Score
- SolidWorks
- Python, C++ & VB Programming
- Machine Learning
- TEM, XPS, XRD analysis
- Project Management, Leadership and Risk Management

References

Professor **Mehdi Divandari**, Iran University of Science and Technology
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