Below are a selected sampling of work performed by the Steel Center faculty members at Missouri S&T. All entries are listed by these categories:

**Steel Making**
- EAF & BOF
- Refining
- Non Metallic Inclusions

**Refractories**

**Foundry**
- Melting and Liquid Metal Processing
- Casting and Solidification
- Refractories and Mold Materials
- Physical Metallurgy

**Continuous Casting**

**Steel Processing** - rolling, forging, welding, heat treatment

**Steel Product Properties**

**Advanced High Strength Steels**

**Modeling & Simulation**

**Energy**

**Environmental**
- Recycling & Life Cycle Assessment
- New Environmentally Friendly Processes
- Coatings & Corrosion

Research projects and publications are listed chronologically by year.
**Projects:**

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<td>Effects of Scrap Analysis on Melting Operations, Phase I -</td>
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<td>Charge Value Optimization</td>
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<td>Steel Deoxidation Study, Phase I &amp; II</td>
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<td>Study to Improve Efficiency of Cupolas through Oxygen Injection</td>
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<td>Modeling of Post-combustion in Electric Furnace Steelmaking</td>
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<tr>
<td>Mathematical Modeling of Slag Splashing</td>
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**Papers:**

STEELMAKING: Refining

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<td>Steel Refining and Continuous Casting Collaborative Research Development of Process to Continuously Melt, Refine, and Cast High Quality Steel</td>
<td>Shougang Research Institute</td>
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<td>AOE</td>
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STEELMAKING: Non Metallic Inclusions

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Papers:

# REFRactories

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<td>Steelmaking Nozzles that Resist Clogging</td>
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<td>Steel Foundry Refractory Lining Optimization: Electric Arc Furnaces</td>
<td>DOE</td>
<td>1999-2002</td>
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<tr>
<td>Development of Submerged Entry Nozzles that Resist Clogging</td>
<td>AISI/DOE</td>
<td>1997-98</td>
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<tr>
<td>Research and Development in Reducing and Recycling Spent Refractories from Metal Producing Industries in Missouri</td>
<td>MDNR</td>
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## Papers:

Projects:

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<td>High Performance Alloy Materials and Advanced Manufacturing of Steel Castings for Improved Weapon System Reliability</td>
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<tr>
<td>Basic Model for EAF Clean Cast Steel</td>
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<td>Study to Improve Efficiency of Cupolas through Oxygen Injection</td>
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Projects:

- **Lightweight Steel Encapsulation of SiC Tiles**
  - **Sponsor:** BAE Systems
  - **Date:** 2010-11

- **Manufacturability Improvement for P900 Effector Plate for Energy Absorbing Blast Protection**
  - **Sponsor:** Leonard Wood Inst
  - **Date:** 2008-09

- **Manufacturing of Steel Castings for Improved Weapon System Reliability**
  - **Sponsor:** Army
  - **Date:** 2007-10

- **High Performance Alloy Materials and Advanced Manufacturing of Steel Castings for Improved Weapon System Reliability – Yr2**
  - **Sponsor:** Army
  - **Date:** 2007-10

- **High Performance Steels**
  - **Sponsor:** ATI/DOE
  - **Date:** 2007-09

- **P900 Armor Castings with High Energy Absorbing Properties**
  - **Sponsor:** Leonard Wood Inst.
  - **Date:** 2007-08

- **Light-Weight Steel Castings for Ceramic Armor Systems**
  - **Sponsor:** Nextec
  - **Date:** 2007-08

- **TTR Phase I: Rapid Freeze Prototyping of Investment Cast**
  - **Sponsor:** O'Fallon Casting
  - **Date:** 2007

- **Analysis of Weight Loss During Investment Cast Process**
  - **Sponsor:** O'Fallon Casting
  - **Date:** 2005

- **ESMART Energy Efficiency in Melting: Precision Casting**
  - **Sponsor:** ATI/DOE
  - **Date:** 2004-10

Papers:

PROJECTS:

Project Name: Burnt-on/Burnt-in Sand Defects in Steel Castings
Sponsor: SFSA
Date: 2001-04

Project Name: Silicon Carbide Behavior in Ferrous Melting Process Studies
Sponsor: Katz
Date: 2001-03

Project Name: Steel Foundry Refractory Lining Optimization
Sponsor: DOE
Date: 1999-2002

PAPERS:

FOUNDRY: Physical Metallurgy

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<td>Development of Lightweight Steel P900 Castings for Future Combat Systems</td>
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<td>Manufacturing of Steel Castings for Improved Weapon System Reliability</td>
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<td>Improved Design and Tolerancing Practice for Casting Machinability</td>
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<td>High Performance Steels</td>
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CONTINUOUS CASTING

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<td>Modeling Fluid Flow in Continuous Centrifugal Casting</td>
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<td>Steelmaking Nozzles that Resist Clogging</td>
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<td>Relationship of Mn/Si Ratio to Continuous Casting of Structural Steels</td>
<td>Nucor-Yamato Steel</td>
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<td>Development of Submerged Entry Nozzles that Resist Clogging</td>
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STEEL PROCESSING: Rolling, Forging, Welding, & Heat Treatment

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<td>Effects of Steel Processing on Austenitic Grain Size-Phase I</td>
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STEEL PRODUCT PROPERTIES

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<td>Design and Testing of Coating Interface Fatigue Specimen</td>
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<td>Inclusion Characterization System for Material Behavior</td>
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<td>Mechanical Property Evaluation of Fe-(Cr,Mo)-B Hard-facing Alloys</td>
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<td>Evaluate Carbide Stabilities in Cast Stainless Steel</td>
<td>SFSA</td>
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<td>Tailoring Fe-Base Alloys for Intermediate-Temperature SOFC Interconnect</td>
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ADVANCED HIGH STRENGTH STEELS

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<td>Development of Lightweight Steel P900 Castings for Future Combat Systems</td>
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<td>Development of Nano-acicular Duplex Steels</td>
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<td>High Performance Alloy Materials and Advanced Manufacturing of Steel Castings for Improved Weapon System Reliability</td>
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<td>Cast High Quality Steel</td>
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Papers:

Ingate and Filling Design for the Reduction of Inclusion Entrapment During Steel Ingot Teeming Process Ingot

IMF

2009-11


ENERGY

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ENVIRONMENTAL ASPECTS OF STEEL MANUFACTURING: Recycling and Life Cycle Assessment

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<td>Metals Recovery from Spent Refractory Phase I - Characterization</td>
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<td>Life Cycle Greenhouse Gas Emission Comparison Of Steel with Other Materials</td>
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<td>Research and Development in Reducing and Recycling</td>
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<td>Spent Refractories from Metal Producing Industries in Missouri</td>
<td>MDNR/Gray Automotive</td>
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<td>Research and Development in Recycling Used Automotive Oil Filters</td>
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ENVIRONMENTAL ASPECTS OF STEEL MANUFACTURING: New Environmentally Friendly Processes

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<td>Cerium-based Conversion Coatings for Aerospace Applications</td>
<td>PPG Industries</td>
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<td>Inorganic Structure of Corrosion Inhibitors and Coating Performance Studies</td>
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<td>Corrosion Inhibiting Electrocoat System for Body-in-White Assemblies</td>
<td>GM/USAMP</td>
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<td>Corrosion Finishing/Coating Systems for DoD Metallic Substrates Based on Non-Chromate Inhibitors and UV Curable, Zero VOC Materials</td>
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