Iron Metallics Market Developments

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IIMA Vice Chairman/Metalloinvest
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STRUCTURE OF THE PRESENTATION

- International Iron Metallics Association
- The role of Ore Based Metallics (OBM) in steelmaking
- Global Iron Metallics Markets:
  - Scrap
  - Merchant Pig Iron
  - DRI/HBI
- Summary/Conclusions
International Iron Metallics Association
IIMA MEMBERS

Producers of Merchant Pig Iron (MPI), Hot Briquetted Iron (HBI), Direct Reduced Iron (DRI) and Iron Nuggets

Suppliers of raw materials, logistics, technology, equipment, consultancy, etc.

Traders/Distributors

Consumers of ferrous metallics

103 members in 36 countries
PURPOSES

**PROMOTE**
The use of ore-based metallics in steel production and iron casting

**REPRESENT**
The collective interest of members

**COLLECT & PRESENT**
Trade statistics and Industry data

**PROVIDE**
A forum for technical co-operation and exchange of views

**REALIZE**
Projects and technical studies of common interest
CURRENT INITIATIVES

- World Steel Association – Affiliated Member
- International Council on Mining & Metals – Associate Member
- International Maritime Organisation – Consultative status
- Dry Bulk Terminals Group – Cooperation Agreement
- Association for Iron & Steel Technology – Personal memberships
- South East Asia Iron & Steel Institute – Affiliate Member
- Steel Manufacturers Association, Arab Iron & Steel Union, Sponge Iron Manufacturers Association, a number of National and Regional Foundry Associations – working relationships
ROLE OF ORE BASED METALLICS IN STEELMAKING
DRI, HBI, pig iron and iron nuggets are manufactured from iron ore, they are ore-based metallics (OBMs). Other names: Virgin metallics, primary iron, etc.

OBMs are best used as **SCRAP SUPPLEMENT** to dilute impurities in ferrous scrap in EAF steelmaking.

HBI can be used in BOF steelmaking and in BF ironmaking.
Low residuals content reduces impurities in steel
Consistent predictable chemistry, mass and heat balances
Controlled C content, consistent C recovery
Better slag foaming
Continuous feeding and high density feedstock
More consistent EAF operations
Lower N content in liquid steel
Stable year-round production and supply
STEEL SPECIFICATIONS AND METALLICS FEED QUALITY

### Metal Specifcations

<table>
<thead>
<tr>
<th>Metallics Type</th>
<th>Cu Content</th>
<th>Value Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1 Dealer Bundles</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Bushelling</td>
<td>0.08 - 0.1</td>
<td>0.8</td>
</tr>
<tr>
<td>#1 HMS</td>
<td>0.25 – 0.35</td>
<td>0.3</td>
</tr>
<tr>
<td>#2 HMS</td>
<td>0.4 – 0.6</td>
<td>0.5</td>
</tr>
<tr>
<td>#1 Shredded</td>
<td>0.15 – 0.2</td>
<td>0.17</td>
</tr>
<tr>
<td>#2 Shredded</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>P&amp;S</td>
<td>0.12 – 0.2</td>
<td>0.15</td>
</tr>
</tbody>
</table>

### Metallics Types

- **HBI/DRI**: 0.002 (depends on ore) | 0.0
- **Pig Iron**: 0.002 (depends on ore) | 0.0

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**Charging Mix is Determined by Product Quality Requirements**

The inherent cost of a point (0.01 weight %) of copper in the scrap has been determined to be approx. $2.00.
IIMA Metallics VIU study - US steel industry consultant Jeremy Jones.

The first stage: estimation of harmful impurities influence.

The calculation was based on typical content of copper and historical price evaluations for various scrap grades, HBI and pig iron on the US market for the last 10 years.

Value-in-use was determined by calculating the cost of a ton of premium scrap compared to the cost of a blended ton of OBM and lower grade scrap to achieve the same Fe input and copper level as that contained in the higher grade scrap.

The analysis has shown that considerable savings can be accumulated through replacement of premium scrap for OBM and lower grade scrap blend: from - 43$ to 331$ per ton of metallics blend over the 10 year period. Average savings were $5.50 - $53 per ton of metallics.

The project demonstrates the possibility of metallics costs reduction by combination of OBM and scrap use in EAF steelmaking.
## MERCHANT OBM CONSUMPTION IN 2012

<table>
<thead>
<tr>
<th>Main importers</th>
<th>Merchant HBI/DRI consumption, mln. t</th>
<th>Consumption of MPI, mln. t</th>
<th>EAF steel production, mln. t</th>
<th>Average OBM consumption per 1 t of EAF steel*, kg/t</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>2.76</td>
<td>4.27</td>
<td>53.5</td>
<td>108</td>
</tr>
<tr>
<td>Italy</td>
<td>0.51</td>
<td>1.11</td>
<td>17.9</td>
<td>72</td>
</tr>
<tr>
<td>Spain</td>
<td>0.44</td>
<td>0.27</td>
<td>10.2</td>
<td>62</td>
</tr>
<tr>
<td>South Korea</td>
<td>0.43</td>
<td>0.83</td>
<td>26.6</td>
<td>38</td>
</tr>
<tr>
<td>Turkey</td>
<td>0.38</td>
<td>1.38</td>
<td>26.6</td>
<td>51</td>
</tr>
<tr>
<td>Russia</td>
<td>0.22**</td>
<td>0.80</td>
<td>16.2***</td>
<td>52</td>
</tr>
</tbody>
</table>

* it is assumed that 70% of pig iron is consumed by steel industry and 30% by foundry industry
** domestic supply of HBI from Lebedinsky GOK
*** excluding OEMK

Source: IIAM, AME, Metalloinvest estimations
GLOBAL METALLIKS MARKETS
2013 GLOBAL SCRAP TRADE
91 MT (est.)

In million mt

- Net importer of more than 5 Mt
- Net importer of 1-5 Mt
- Net exporter of more than 5 Mt
- Net exporter of 1-5 Mt

Top 5 Exporters and Importers of Scrap

<table>
<thead>
<tr>
<th>Exporter (e)</th>
<th>Importer (e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>17.7</td>
</tr>
<tr>
<td>Germany</td>
<td>8.2</td>
</tr>
<tr>
<td>Japan</td>
<td>8.0</td>
</tr>
<tr>
<td>UK</td>
<td>6.6</td>
</tr>
<tr>
<td>France</td>
<td>6.0</td>
</tr>
</tbody>
</table>

Source: ISSB, IIMA, Metalloinvest estimations
Prime scrap: limited availability

Obsolete scrap: recent significant increase of scrap recovery rates and exports in the USA, EU – will it come back to historical levels?

EU Steel Action Plan: monitoring and control of scrap export from Europe.

Forecasted obsolete scrap increase in China: what would be left for exports and when? Export of scrap = export of energy.

Climate change policies, ambitious carbon emissions reduction targets will stimulate domestic scrap use.

Introduction of carbon emission trading system in China in 2013 in testing regime in several provinces and in the national level from 2015 will further stimulate energy saving technologies.
2013 GLOBAL PIG IRON TRADE 12 MT (est.)

In million mt

- Net importer of more than 0.5 Mt
- Net exporter of more than 0.5 Mt
- Net importer of 0.1-0.5 Mt
- Net exporter of 0.1-0.5 Mt

Top 5 Exporters and Importers of Pig Iron

<table>
<thead>
<tr>
<th>Exporter (e)</th>
<th>Importer (e)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Russia</td>
<td>USA</td>
</tr>
<tr>
<td>Brazil</td>
<td>Italy</td>
</tr>
<tr>
<td>Ukraine</td>
<td>S.Korea</td>
</tr>
<tr>
<td>India</td>
<td>Taiwan</td>
</tr>
<tr>
<td>S.Africa</td>
<td>Turkey</td>
</tr>
</tbody>
</table>

Source: ISSB, IIMA, Metalloinvest estimations
Two groups of consumers: EAF steel mills (60-70%) and iron foundries (30-40%).

Iron Foundries: big variety of foundry PI grades, higher quality requirements; dedicated producers in RSA, Canada, Norway, Germany, partly in Brazil and in Russia.

MPI production cost pressure and market conditions: significant part of charcoal BFs in Brazil remain idle, some Russian MPI BFs are out of operation.

Russian Tulachermet, the biggest MPI plant, announced an intention to move into 1.5 mtpy steel production and to reduce MPI sales.

Ural Steel of Russian Metalloinvest Group is planning to increase MPI sales up to 2 mtpy.
Meeting with AIIS Management – Nov 7, 2011

2013 GLOBAL HBI/DRI TRADE
9 MT (est.)

- Net importer of more than 0.5 Mt
- Net importer of 0.1-0.5 Mt
- Net exporter of more than 0.5 Mt
- Net exporter of 0.1-0.5 Mt

In million mt

Top 5 Exporters and Importers of HBI/DRI

<table>
<thead>
<tr>
<th>Exporter (e)</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Russia</td>
<td>USA</td>
</tr>
<tr>
<td>Trinidad</td>
<td>S.Korea</td>
</tr>
<tr>
<td>Oman</td>
<td>India</td>
</tr>
<tr>
<td>Venezuela</td>
<td>Italy</td>
</tr>
<tr>
<td>Malaysia</td>
<td>China</td>
</tr>
</tbody>
</table>

Source: ISSB, IIMA, Metalloinvest estimations
76% of DRI is produced in gas based shaft furnaces, 23% - coal based (mainly India)

Further development of shaft furnace Direct Reduction technology: availability of gaseous reductant (natural gas, shale gas, synthetic gas) and iron ore of suitable quality.

New DR capacities in MENA, in India are developed as a part of integrated steel mills.

Direct Reduction in the USA: Nucor Louisiana – 2.5 mtpy DRI, December 2013; Voest Alpine Stahl, Texas – 2.0 mtpy HBI, 2016; several projects under discussion.

Direct Reduction, Russia: Metalloinvest LebGOK – 1.8 mtpy HBI; total HBI capacity in 2016 – 4.5 mtpy.
International Iron Metallics Association provides wide range of services related to various aspects of OBM production, consumption, shipments, market developments etc.

The use of OBM in steelmaking allows to improve EAF performance and to produce higher quality steel products when scrap is used in combination with OBM.

OBM Value-in-use study confirms the possibility of EAF metallics costs reduction by blending of OBM with lower grade scrap.

Scrap: limited availability of premium grades; long term forecasts for obsolete scrap increase in China.

Scrap: Ambitious carbon emission reduction targets, development of national emission trading schemes (including China) will stimulate domestic scrap use in steelmaking.
SUMMARY

- Merchant Pig Iron: Relatively low utilization rate of existing capacities, production costs pressure.
- Direct Reduction: Development of integrated steel mills based on DR technology: MENA, India – no long term HBI or CDRI sales are planned.
- Further development of DR projects in the USA, including HBI supply into the market – pressure on metallics imports.
- Russia: Construction of 1.8 mtpy HBI-3 plant at Lebedinsky Iron Ore Mine of Metalloinvest will bring total HBI capacity in 2016 up to 4.5 mtpy.
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