A modern version of the bloomery process

V. Vitry
UMONS – Engineering Faculty – Metallurgy Unit

The bloomery process has been used for iron production in Europe from the Iron Age (ca. 1500 BC) to the late Middle Ages (ca 1400 AD). The principle of this reactor is the reduction in solid phase of iron ore by solid carbon, brought in the form of charcoal, and probably carbon monoxide, generated by the partial combustion of the charcoal, that also gives the energy necessary for the reaction.

How the bloomery process works

Iron is reduced by C and CO as it goes dow the shaft

Our analysis of the process and products

Formation of two blooms near the bellows

Our philosophy: creating, with modern materials and instruments, a tool that reproduces the phenomena of the bloomery process

Conclusions

We were able to implement the reduction of iron ore by the bloomery process, using modern materials, tools and instrumentation. Two iron blooms of relatively good purity were obtained. In the future, improvements will be made to the design of our bloomery:

- Use of compressors with a higher power, and with tunable outlet temperature.
- Use of inclined bellows (instead of horizontal ones)
- Use of higher grade thermocouples (type R (Pt/PtRh) instead of type K) and bellows
- The possibility of fabricating a reusable bloomery is under investigation

The bloomery process as it was implemented during the ages

Early iron age: Middle ages

Later process

And as people of our time reproduce it usually

Our temperature recorded in the steady state at various positions in the furnace

Chemistry of the blooms (at.%)

<table>
<thead>
<tr>
<th></th>
<th>Bloom</th>
<th>Magnesium</th>
<th>Iron</th>
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<tbody>
<tr>
<td>Left</td>
<td>0.48</td>
<td>99.4</td>
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<tr>
<td>Right</td>
<td>0.38</td>
<td>99.5</td>
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Chemistry of the slag (at.%)

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