MiMeR

Minerals and Metals Recycling Research Centre

LULEÅ UNIVERSITY OF TECHNOLOGY

Modelling Environmental, Technical and Economical Aspects of Tramp Element Accumulation in Scrap Recycling

N. Menad
Div. of process metallurgy, Luleå University of Technology, SE- 97187, Luleå Sweden

Abstract

Impurities called "Tramp Elements" are a considerable problem concerning the future of sustainable development of the steel industry. Difficulties in removal of these impurities can be encountered, throughout the steelmaking process, when they are dissolved into the liquid metal originating from poorly prepared Scrap material used in recycling.

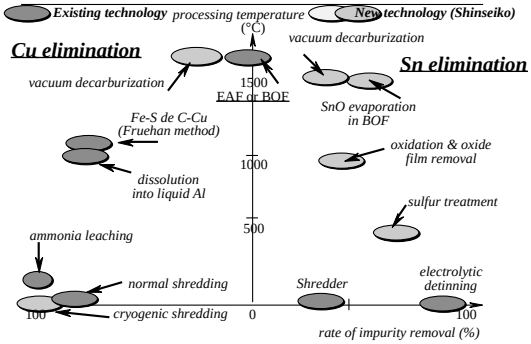
To cope with future demands on not only environmental awareness, but also with technical and economical aspects of steel production, it is necessary to develop an effective steel recycling system to optimise the recycling rate of steel, and introduce operations to ensure production of competitive steel grades, using scrap.

Modelling of "Impurity Accumulation" is a necessary procedure in evaluating the required degree of scrap sorting or purification by accurately determining the loss of impurities throughout the steelmaking process. The loss of impurities through processing and the tolerance levels in steel can dictate the requirements of the charge or scrap materials.

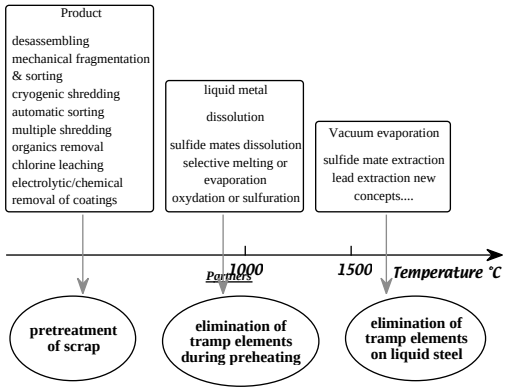
Objectives

To determine the tramp element distribution behaviour occurring with various forms of scrap input material. Distribution between the bath, slag and gas phases is to be studied, using industrial data or laboratory simulation. To incorporate the use of Life Cycle Analysis (LCA) to study the various processing routes which provide environmentally aware technology that comply with technical feasability. To employ these techniques to strengthen the sustainable development in the recycling of steel, and to aid in the formation of bonds between scrap and steel industry.

Distinction between new technology introduced in the project of Shinseiko Forum and technology already in application or proposed in a different context



General view of different processes for preparing or pre-treating scrap



Model

Mass balance:

$$E_{i,scrap} = E_{i,steel} + E_{i,slag} + E_{i,gas}$$

$$\sum_{j}^{n} \alpha_j W_{scrap} [E_i\%]_j \le E_{i,scrap} \qquad \sum_{j}^{n} \alpha_j W_{scrap} P_j = Minimum$$

Quality limit

Databases

Content of tramp elements in scrap of all classes;
Prices of all scrap classes;
Other data.

Rautaruukki	Finland
Ovako Steel, Oxelösund AB	Sweden
SSAB Tunnplåt AB	Sweden
Stena Metall AB	Sweden
FLOGEN Technologies Inc.	Montreal,Canada

Researche program

The project will consist of the following activities:

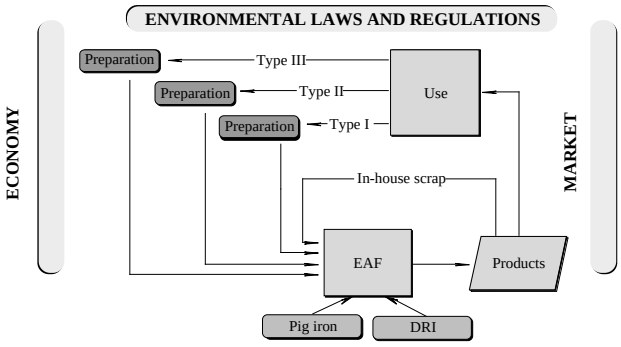
Task 1. Literature survey and evaluation of necessary data for the model, *e.g.* the distribution of tramp elements to the different phases occurring in the process steps of steel making.

Task 2. Establishment of the model for technological, environmental and economical effects of an increased recycling rate.

Task 3. Refining of the data, possibly complemented with further sampling at industries and/or laboratory experiments.

Task 4. Application of the model to different recycling scenarios.

Task 5. Report and paper writing.



DISTRIBUTION OF TRAMP ELEMENTS