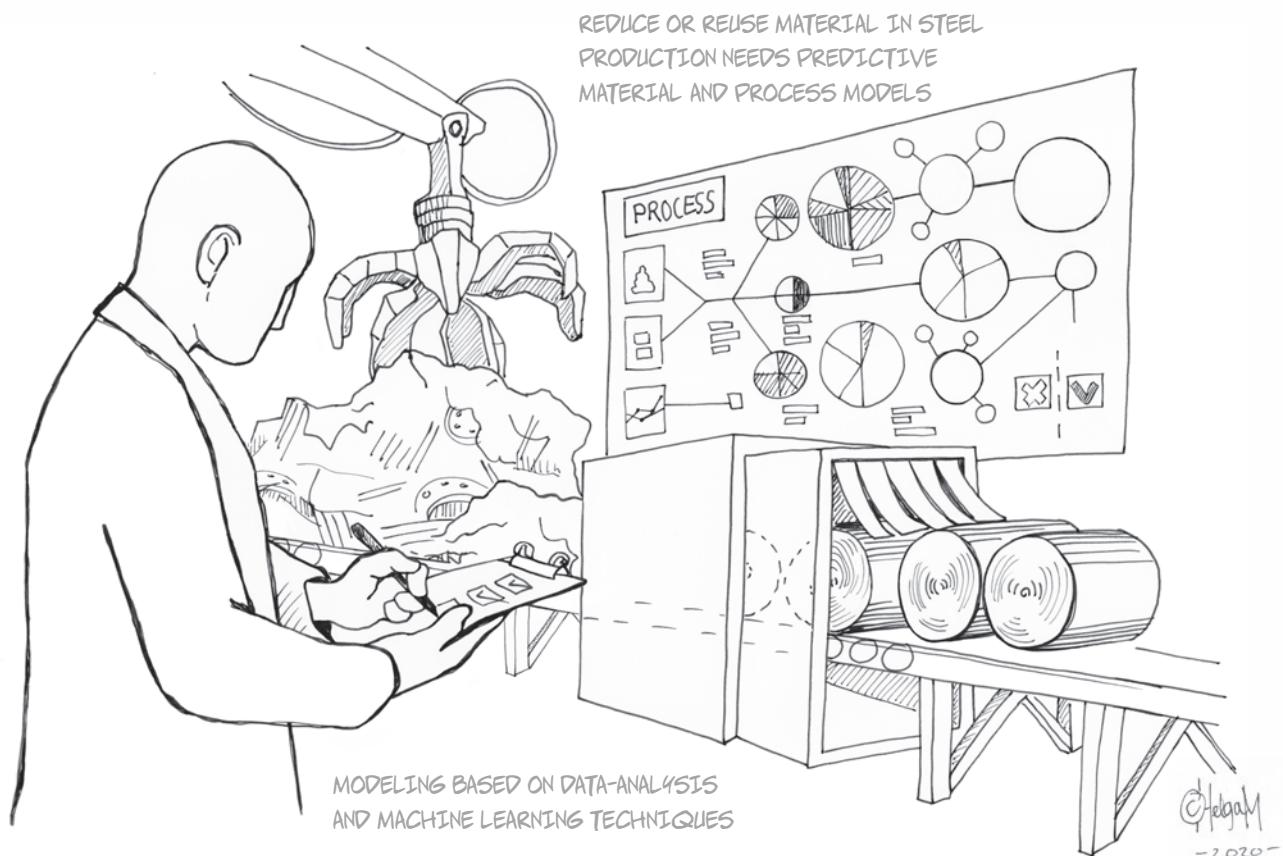


### Improved modeling approach

Data enhanced physical models to reduce material use in steel production



A significant part of Dutch (and worldwide) energy consumption and carbon emission is related to the production of primary metals, especially steel. In order to become more sustainable, either less energy must be used to produce the material or less material must be used. Materials reduction can be achieved by recycling, by increasing the materials life, or by reducing the amount of material required through improved properties and design. A quest for a radically improved materials modeling approach.

## A game changer in materials modeling

Steel produced from ore has excellent quality and can be produced within strict tolerances, which are prerequisites for subsequent steps in today's manufacturing processes. For materials reduction in producing steel for high-end applications, we need to improve the structural properties, recycling rates, and durability of materials by tens of percents.

### Using less energy

Significant energy savings can be achieved by producing metals from scrap (recycling) instead of ore. However, the higher the content of scrap, the more difficult it is to maintain the required quality standards and tolerances. This hampers increased use of scrap in steel production for high-end applications. Material properties not only depend on composition, but also on the production process. Composition variations can be compensated for by adapting the process. To achieve material of constant quality, excellent predictive material and process models must be available.

### Using less material

Another significant saving can be reached by adapting the material properties to the specific need of an application, such that the same product performance (e.g. strength) can be met with less material. Specific materials will be produced in smaller batches than current bulk products and for each specific material predictive models must be available to optimize the following production steps. It is therefore required to develop these models quickly and efficiently for each specific material.

### Data enhanced predictive modeling

Models currently in use are usually based on mathematical descriptions of the underlying physics. Physics based models are not accurate enough for process compensation of variations in steel produced with higher scrap ratio. The absence of sufficiently accurate models is hampering the adoption of recycled steel and small batch special purpose steel.

This project focuses on creating and enhancing physical models that are qualified for baseline behavior with data-analysis and machine learning techniques to quickly adapt predictive models to specific compositions. The availability of such models is essential for the adoption of recycled steel in high-end applications.

### Quick Facts

|                  |                                                                                                                            |
|------------------|----------------------------------------------------------------------------------------------------------------------------|
| Project title    | Data enhanced physical models to reduce material use: a game changer in materials modeling                                 |
| Social theme     | Climate and Circular Economy                                                                                               |
| Project partners | University of Twente - Nonlinear Solid Mechanics<br>Tata Steel Europe, Netherlands<br>Materials innovation institute (M2i) |

### HiTMaT

The HiTMaT Call (Connecting High Tech pps in Maatschappelijke Thema's) is an incentive programme of Top Sector HTSM to stimulate high tech innovation, highlight the importance of innovation in addressing social themes and mission, and inspire consortia to develop promising high tech solutions in pps research programmes.