

# Application Report

## Metal Pickling in the Steel Industry

Pickling is a metal surface treatment used to remove impurities such as stains, inorganic contaminants, rust or scale from ferrous metals. A solution called pickle liquor, which contains strong acid is used to remove the surface impurities. It is commonly used to de-scale or clean steel in various steelmaking processes, especially for the production of cold rolled steel strip, to remove the mill scale from the previous hot rolling process.

### Benefit

The stability and the effectiveness of the pickling process depend very much on the constant concentration of iron ( $Fe^{2+}$ ) in hydrochloric acid (HCl).

The installation of a ColorPlus allows for control of the accurate measurement of the iron concentration and correct dosage of HCl to the bath.

This ensures both, a secure process and an optimised addition of HCl resulting in lower acid usage and considerable savings.

### Typical Application

The operation is usually carried out continuously by passing the steel strip through a series of tanks containing hydrochloric acid.

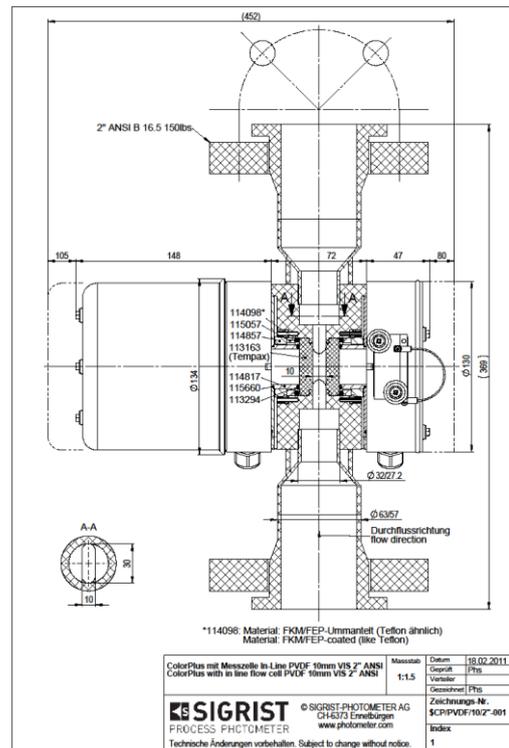
Fresh acid is added to the tank from which the strip leaves the pickling solution to compensate for the acid consumed by chemical reaction with the ferrous metal surface of the strip.

The indication for the amount of HCl needed to be added is given by the iron concentration measured in the HCl solution.

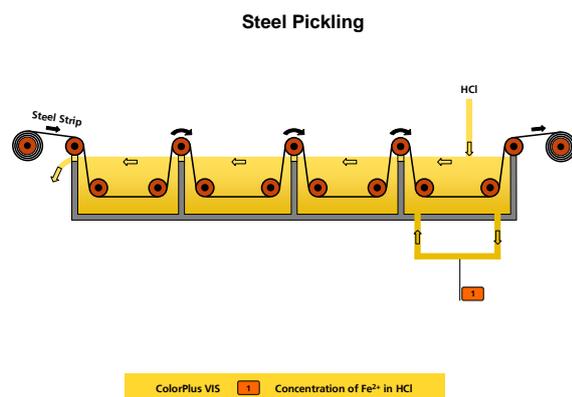
The precise dosing will be achieved by using a ColorPlus VIS in-line process instrument. The working principle is absorbance, whereby a light from a LED light source with a wavelength of 760 nm is transmitted through the medium to be measured.

A special measuring cell made from PVDF with an optical path length of 10 mm withstands the harsh process conditions.

The blueprint below shows the system consisting of a ColorPlus with the special PVDF measuring cell.



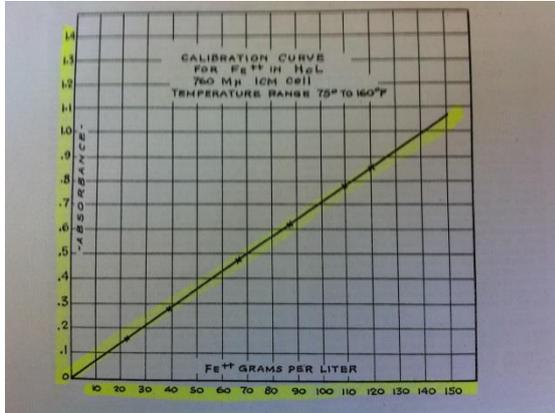
Picture 2: Blueprint ColorPlus with PVDF flow cell



Picture 1: Schematic of the pickling process

Each steel work has several pickling lines, so there's a good potential.

### Practical Measurement (Example)



This diagram shows the calibration curve of Fe<sup>2+</sup> in HCl

The typical measuring range is from 0....200 g/l Fe<sup>2+</sup> in HCl

The calibration is done on site by comparing the absorbance reading from the ColorPlus with the lab measurement. The correlation factor between the absorbance and Fe<sup>2+</sup> concentration is then programmed into the ColorPlus via the SICON control unit.



Picture 3: Pickling station in a steel plant

### Product

#### SIGRIST Product und Configuration for this Application:

- Basic instrument 1 VIS in-line: ColorPlus 2
- LED ColorPlus 760 nm
- In-line measuring cell PVDF with 2" ANSI flanges
- SICON control unit

#### Parameter Setting

- Programming the correlation factor between the absorbance and Fe<sup>2+</sup> into the SICON control unit
- Selection of the desired switching point g Fe<sup>2+</sup> / l in HCl

#### Advantage of the SIGRIST ColorPlus

- LED light source, only 2 W power consumption
- Extremely low cost for maintenance



Picture 4: ColorPlus with PVDF flow cell