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## Investigation on the use of organic acids to pickle the oxide scale of carbon steel hot rolled strips

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Carbon steel strips are produced following a series of processes to convert the cast slabs to a coil of flat steel with required dimensions. The hot rolled coil has a protective and adherent layer of oxide scale from 5 to 15  $\mu$ m thick. Before further processing, this layer of scale is removed in a process known as pickling, which consists of dissolution of the oxides by immersing the steel strip in a bath with strong inorganic acids. The efficiency of the typical inorganic acids: HCl, H2SO4, HNO3 and HF on removing iron and other oxides is unquestionable, however they are hazardous acids with disputed sustainability records.

In this study we investigated the substitution of traditional acids by organic acids. The use of organic acids offers several advantages, including biodegradability, absence of 'dangerous' classification, low hazard for humans, the potential for production from carbon dioxide (CO2), and the option to employ regeneration methods other than combustion. Additionally, communities near steel plants have expressed concern about the disagreeable odours associated with the traditional pickling, making the use of organic acids an appealing alternative that could address this issue.

In this investigation, the pickling power of a selected number of organic acids was determined by performing laboratory scale pickling tests on industrially produced hot rolled steel strips. Out of the study, two organic acids give promising results as possible alternative pickling agents: formic acid and methanesulphonic acid. We demonstrated that these two organic acids can lead to a similar pickle-ability to inorganic acids by an appropriate combination of scale breaking, pre-heating of the strip and elevated temperatures on the pickling bath.

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