

# NON STICKING FURNACE ROLLS FOR STEEL PRODUCTS TO IMPROVE SERVICE LIFE AND PRODUCT QUALITY IN CONTINUOUS ANNEALING AND GALVANIZING LINES: PRELIMINARY STUDY ON CHEMICAL INTERACTIONS AND PICKUP MECHANISM

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Thermal spray cermet coatings are successfully applied on furnace rolls in continuous annealing and galvanizing lines. However, when processing HSS with high manganese and/or high silicon content, oxide pickups can be formed on the rolls working in the different furnace zones.

The aim of this study was to acquire knowledge on the pickup mechanisms and the chemical interactions occurring between different cermet coatings and steel grades as a function of factors such as dew point, furnace temperature, surface roughness, etc.

Aged Cr<sub>3</sub>C<sub>2</sub>-NiCr and Al<sub>2</sub>O<sub>3</sub>-Co based matrix coatings were made to interact with pre-oxidized steels characterized by different levels of Mn and of Si by high temperature (800°C<T<900°C) static reactivity tests and low temperature (400°C< T <600°C) dynamic tests, which allow the friction of a roll on a steel strip at controlled temperature and furnace atmosphere. The interaction surfaces were then characterized by XRD, GDOES, AES, SEM-EDS.

The high temperature interaction tests results indicate that when aged cermet coatings have at their surface Cr<sub>2</sub>O<sub>3</sub> and/or Al<sub>2</sub>O<sub>3</sub>, then MnAl<sub>2</sub>O<sub>4</sub> and Mn<sub>1.5</sub>Cr<sub>1.5</sub>O<sub>4</sub> spinels will form with all the steels that have a sufficiently high Mn content. However, if coatings are aged at a DP of -30°C/-40°C, a nitride surface layer is produced that seems to affect the interactions with MnO.

Dynamic tests at low temperatures results indicate that coating roughness strongly influences pickups, and has to be limited as much as possible. In laboratory tests and industrial lines, iron pickup is principally observed. Some silicon oxide pickup has also been reported on industrial rolls during electrical steel processing. The pickup studies at high temperatures have also indicated MnO pickup, which is in good agreement with analyses made on industrial rolls in the soaking area. Again the coating roughness has a significant effect on pickup, but the presence of Al and Cr oxides on the roll surface also increases reactivity with the formation of spinels after the reaction with the selective oxidation covering the strip. Therefore, the suppression of the metallic Al/Cr incorporated in the NiCr and Co/Ni matrix of the cermet coatings should suppress this reactivity and could limit the pick-up.

## Keywords

cermet coatings, furnace rolls, CAL, CGL, pickup mechanism, HSS

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