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Hardfacing of transport rollers contacts in steel mill plants

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Transport rollers in steel mill plants support large, heavy and hot steel sheets in their movements to/between different mills, to a cooling section and finally to a storage place. The rollers have outer diameter/length of approx. 400/1000 mm and are water cooled. Nominal Hertzian pressure in a cylinder to plane type contact is below 100 MPa while the steel sheet temperatures are between from 1300°C before the first mill to 600°C when entered the cooling section. The rollers are manufactured by centrifugal casting from mild carbon or low alloyed steels, with/without hardfacing and with/without grinding. Non-hardfaced rollers experience much shorter useful life.

Hardfacing of the transport rollers is made by different thermal powder spraying techniques, such as flame spraying dated to 1930', plasma transferred arc (PTA) dated to 1970' or laser cladding in industrial use from 1980'. Depending on the powder and the coating technique, the hardfaced roller surface is more or less wavy. For some applications the wavy hardfaced surface do not need to be altered, but for transport rollers the waviness had to be removed by grinding to prevent damaging of the transported steel sheets.

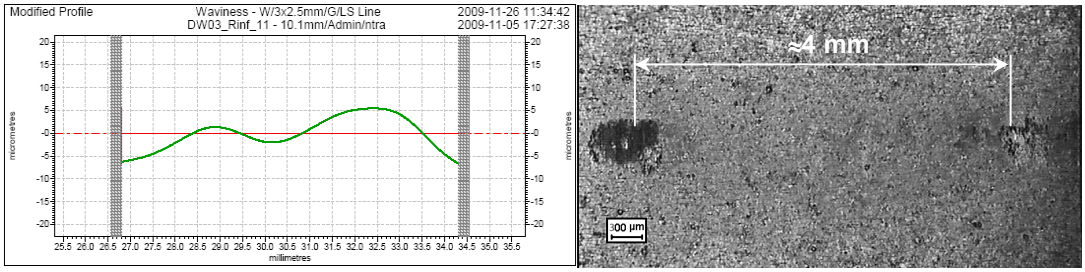

Figure 1. A wavy hardfaced, not-ground, roller surface profile before (left) and its worn wave tops after wear testing (right).

Contact of flame spray hardfaced but not ground transport rollers against steel sheet was simulated in laboratory condition by using a cylinder to cylinder test setup. After flame powder coating and subsequent flame sintering, the rollers surface achieved a wavy profile with wave spacing of about 4 mm and wave top curvature about 100 mm, see Figure 1 left. The nominal contact pressure was 20 MPa, the sliding velocity 1 m/s, contact surface were degreased and no lubricant was used. As seen in Figure 1 right, the contact was established at first at the wave tops followed with severe oxidative wear and friction coefficient exceeding 0.6 and causing severe wear of counter C45–steel cylinder.

The test results show a need to achieve more basic understanding about how the powder and coating technique affect surface profile of the coated components. Introduction of laser cladding opens some new possibilities thanks to its principal coating process benefits and robotization opportunities.