Abstract

The cement industry is considered a complex and heavy industries. This industry faces several problems because it is an industry dependent on high temperatures and using complex mechanical techniques and one of the most important of these problems is the continued wear of the basic parts of the clinker cooler. This research attempts to find appropriate solutions to this problem through improved mechanical wear and increase the resistance of the grate plate which made from "High chromium austenitic alloy steel " to reduce the time and the cost of maintenance for the clinker cooler. The experimental work includes recognizing the chemical composition of grate plate , preparing the samples of grate plate for chemical composition test according to American Society for Metals (ASTM A-532) and the German organization Institute for Standardization (DIN1695) as well as preparing samples for mechanical tests e.g impact, hardness and wear (pin on disk). Finally, preparing samples for testing inside a clinker cooler under actual operating conditions. The morphology of the surface of the specimen was tested by SEM and EDS. The thermal coating machine high velocity oxeye fuel (HVOF) was used for coating the base metal specimens of grate plate ingot with tungsten carbide nanoparticles (WC). The coating process was conducted for three values of thickness (300, 500 and 650 μm). The wear tests result showed that the weight loss decreases when there was an increase in thickness of the nanoparticles of (WC) as a coating material till it reaches a thickness of (650μm). The results of the field test sample inside the clinker cooler show an improvement in wear resistance by about (51%), while the improvement reaches (83%) in the standard wear test (pin on disc) and the improvement in precision hardness reaches (32.28%). The weight ratio of tungsten (WC) on the sample surfaces reaches (20.19%) with a layer thickness (650μm). The coating process reduces the consumption rates of the grate plate due to the weight loss of specimen without a coat was about 0.0053% compared with 0.0009% of the coated specimen with a thickness of 650μm. The economic benefit of the coating process is clear when comparing the cost of coating 1265 grates plates in a clinker cooler (120 million ID) compared to (443 million ID) for annual replacement. In addition, the replacement of parts will lead to stop the production of clinker for at least three months. This improvement leads to an increase in service life from 3 years to 5.5 years at the same operating conditions.