Nitriding in Bath of Non-toxic Salts: A Solution to Industrial Pollution

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Salt bath nitriding is an industrial process commonly used to improve the tribological properties of metal materials, and it is based on the nitrogen (N) diffusion into the metallic surface. However, this process uses cyanide salt (CN-), becoming a highly toxic activity. For that reason, I investigated the replacement of this toxic salt by an environmentally friendly solution. I tested potassium nitrate (KNO3) because this salt has nitrogen in its chemical formula and is non-toxic, being used, for example, as a food preservative and in agricultural fertilizers. I developed the methodology focused on a way to get an industrial replicating. For this, I prepared low carbon alloy steel samples by roughing, degreasing and deoxidizing. I inserted a system composed of melting crucible, steel samples, KNO3 and antioxidant elements in a muffle furnace at 650 °C for three hours. I carried out microstructure characterizations with the help of Scanning Electron Microscope, Energy Dispersive Spectroscopy and Vickers Hardness testing. The microstructure findings showed that were a clear conversion of steel surface in iron nitride of high hardness, as a result of nitriding using non-toxic salts. The maximum hardness, as measured by the Vickers method, lies in the range of 700 to 880 HV after nitriding. The studied parameters demonstrated to be efficient in comparison to the conventional method. To summarize, replacing the cyanide (CN-) for non-toxic salt (KNO3) is a simple and greener approach to get nitrogen into the metallic surface to create a case-hardened surface.

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