



TECHNICAL SUMMARY

Heat treating operations can cause a carbonaceous “smut” or metal scale on the surface of ferrous, stainless, and high temperature alloy rod, wire, or flat sheet products. The “hot-section” components of jet engines eventually build up a tenacious scale that must be removed prior to inspection and overhaul.

This smut and scale can be a combination of reduced carbon and metal oxides that are not acid soluble. Effective cleaning of the metal surface is essential prior to the finished coating or plating processes. Poor surface cleaning results in poor adhesion of the finish and excessive die wear.

An aqueous solution of alkaline CAIROX® oxidant effectively converts or oxidizes the smut and scale to acid soluble forms that are removed in the subsequent acid pickling baths. This conditioning of the smut and scale reduces acid pickle time, minimizing acid attack on the base metal.

APPLICATION

After rinsing in water or cleaner to remove shop soil and dirt, the metal is then dipped into the aqueous CAIROX caustic bath for 5 to 30 minutes. Treatment time can vary depending on the type and thickness of the smut and scale to be conditioned for removal in the acid pickle. The bath is made up to 3-5% CAIROX and 6-10% sodium hydroxide (NaOH), and is heated to 85° - 90°C (185° - 195°F). Wire or rod with excessive oxide scale may require an acid bath prior to the CAIROX-caustic step to remove the acid soluble scale.

CHEMISTRY

Smut and Reduced Metal Oxides + CAIROX + NaOH → By-products + Acid Soluble Oxides

DOSAGE

The concentrations of CAIROX and caustic should be monitored. The caustic concentration should not exceed 10%, at which point the permanganate will disproportionate and the conditioning will be adversely affected. CAIROX concentrations are normally controlled at ½ of the caustic concentration. CAIROX and caustic consumption will be dependent on the type and amount of reduced smut and scale.

FACILITY REQUIREMENTS

A mild steel tank is suitable since the bath is not corrosive. The bath should not be heated with open steam. Operators should be trained to monitor CAIROX and caustic concentrations. Temperature controls should be installed to maintain the temperature between 85°C and 90°C (185° - 195°F). Operators should be trained in the proper methods for adding chemicals to the bath and in all the safety and emergency precautions.

BENEFITS

CAIROX caustic conditioning of smut and scale reduces the time in the acid pickle to obtain a clean metal surface suitable for finishing. Reduced acid pickling time reduces the desmutting and descaling over-all cost.

REFERENCES

Mack, Dr. E., *Cleaning and Descaling of Carbon and Alloy Steel Wires by Alkaline Potassium Permanganate Solution*. Reprinted for Carus Corporation, Peru, IL Carus Form #3015

Carus Corporation Brochure, *The CAIROX Method Removes Smut and Scale*. Carus Form # 3016

Staff, *Application of CAIROX Potassium Permanganate in the Aerospace Industry*, Carus Form # 440.

For further information on CAIROX oxidant product characteristics and availability, contact Carus



CARUS VALUE ADDED

LABORATORY SUPPORT

Carus Corporation has technical assistance available to answer questions, evaluate treatment alternatives, and perform laboratory testing. Our laboratory capabilities include treatability studies, feasibility studies, and analytical services.

FIELD SERVICES

As an integral part of our technical support, Carus provides extensive on-site treatment assistance. We offer full application services, including technical expertise, supervision, testing, and feed equipment design and installation in order to accomplish a successful evaluation and/or application.

EQUIPMENT SERVICES

Standard feeders are designed specifically for CAIROX potassium permanganate. Various options and accessories are available to meet a wide range of applications. Custom-Engineered Feed Systems are complete, pre-engineered and prepackaged systems. They provide efficient, dust-free methods of storing, mixing, and feeding CAIROX potassium permanganate. System designs are customized to meet specific applications and customer needs.

CARUS CORPORATION

During its more than 100 year history, Carus' ongoing reliance on research and development, as well as its emphasis on technical support and customer service, have enabled the company to become the world leader in permanganate, manganese, oxidation, and base-metal catalyst technologies.