

Research Programs

Characterization, Evaluation and Removal of Surface Contamination from Pre and Post Heat Treated Parts

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Introduction

Surface contamination during heat treatment process can greatly affect the quality of the end products. Although cleaning the post heat treated parts is considered a value added process in heat treatment, pre heat treated parts cleaning is also important and can influence the subsequent process dramatically. For example, in carburizing process, a carburized part may have different carbon concentrations at same depth but different locations, although the part seemed optically clean, free of oil and splinters and dry. This may be not only due to the part geometry and the furnace operating parameters, but also due to the non-visible diffusion restricting barrier layers on top of the part. The rework of defective parts is time consuming, non-economical and sometimes impossible. The barrier layers have to be removed mechanically, (for example by grinding or blasting), which may lead to inaccuracy in part dimensions. The parts have to be re-heat treated which costs time and money.

This project will characterize different surface contaminants which affect the heat treatment process and will identify the process of cleaning and the chemistry being necessary. Some of the issues to be addressed in this project are:

- Meets a direct and immediate industry need
- Environmentally friendly
- Economically correct
- Remove non-value added operations
- Reduce turnaround time
- Reduce rework
- Eliminate environmentally unfriendly practices

Objectives

The Objectives of this project are:

- Characterize and classify the type of surface contaminations that occur with processes used upstream of heat treating
- Characterize and classify the type of surface contaminations that occur following quenching
- Identify/develop a method or test procedure to reliably evaluate and quantify surface "cleanliness"
- Develop techniques which will lead to improvements in surface cleanliness, surface cleaning equipment design and in the development and use of alternative (green and cost effective) cleaning fluids and processes.

Methodology

The objectives will be achieved by the following tasks:

- Task 1- develop a catalog of surface contaminants from upstream operations
 - Survey CHTE members
 - Survey machining, forming and cleaning fluid manufacturers
 - Literature review
 - Identify families of contaminants
- Task 2 - develop a catalog of surface contaminants after heat treat - quenching or cooling
 - Survey CHTE members
 - Survey quenching and cleaning fluid manufacturers and end users
 - Literature review
 - Identify families of contaminants
- Task 3 - Identify/develop the test methods to reliably and quantitatively evaluate surface and near surface cleanliness
 - Survey CHTE members - current practices
 - Review literature
 - Identify and evaluate existing methods and equipment
 - Design a test methodology for each family of contaminants
 - Customer needs
- Task 4 - Identify, catalog and classify currently available cleaning equipment and cleaning fluids and processes (i.e. cleaning system)
 - Survey CHTE members
 - Literature/Thomas register review
 - Equipment suppliers
 - Cleaning fluid suppliers
 - Determine which cleaning system to use for which contaminant
 - Evaluate the effectiveness and environmental impact of the current systems
 - Survey CHTE members
- Task 5 - Work with cleaning system suppliers and cleaning fluid manufacturers (identified in task 4) to develop an in-line system for pre and post heat treating cleaning that exceed industry requirements
 - Develop a clear specification for cleanliness and environmental impact requirements - CHTE members
 - Identify the cleaning equipment suppliers and Cleaning fluid manufacturers to work with
 - Use results of task 3 (cleanliness testing) to evaluate the new cleaning system