

A Master dissertation project:

# An evaluation of solid carbon dioxide (CO<sub>2</sub>) blasting as a cleaning method to remove soot from textiles after smouldering fire and fire, with the possibility to transfer the method to historical textiles within a museum context

## Introduction

Removing soot from textiles after a fire is a complex process, and traditional cleaning methods utilised today are limited in what they can achieve. Using solid CO<sub>2</sub> blasting as a method to remove soot has revealed promising results on a variation of materials. But the cleaning method has only been tested in a small degree on textiles, and a fundamental mapping of solid CO<sub>2</sub> blasting, also called dry ice, on textiles was therefore the focus of this dissertation.

## Researching the effects of CO<sub>2</sub> blasting on textile material

The approach used to answer the research question “Can CO<sub>2</sub> blasting be used on soot damaged historical textiles?” was a combination of theoretical investigation and practical experiments. A literature search was conducted to establish an overview of current cleaning methods which are in use with regards to removing soot from textiles, as well as to provide an outline of the uses of solid CO<sub>2</sub> blasting in conservation. On the basis of literature sources a theoretical description of how the stages in a fire and soot creation impacts textiles were developed. Further, it were explored how solid CO<sub>2</sub> blasting can clean soot from textiles, and what effect the cleaning method had on the textile.

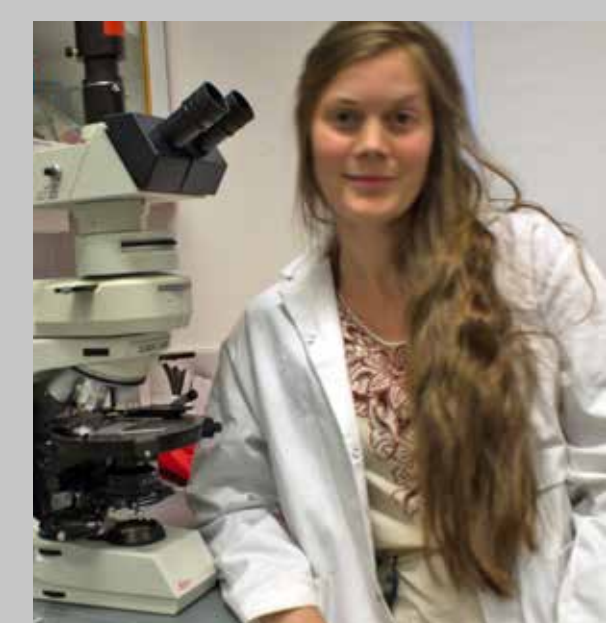
The textile dummies used for the practical experiments was prepared by soot them in a controlled fire in collaboration with the Kongsberg fire department. Three experiments were thereafter performed on the soot damaged dummies. The first experiment comprised of an assessment of solid CO<sub>2</sub> blasting and how the method removes soot from the material. The second experiment compared solid CO<sub>2</sub> blasting with two dry mechanic cleaning methods: soot vacuum cleaning and a soot sponge. The third experiment tested solid CO<sub>2</sub> blasting as a way of removing soot from a three dimensional textile-object. The experiments were evaluated using a selection of qualitative and quantitative analysis methods, such as visual observations, photography, micro-photographic analysis, microscope analysis, SEM-EDS analysis, colorimetric analysis, pH measurement, and textile tensile strength testing.

## Results and conclusion

In general, the dissertation concluded that damages were caused by all of the different cleaning methods that were tested on the textile dummies that were severely heat-damaged by the high temperature from the fire. For textiles that were less heat-damaged, the experiments revealed that solid CO<sub>2</sub> blasting has a potential for removing soot. However, the equipment used today is a risk in terms of further damaging already weakened or damaged textiles. Therefore, further research into the development and adaptation of the solid CO<sub>2</sub> blasting is necessary before this promising method can be recommended for the cleaning of historical textiles.

Mari Grønland, Master student of the Object Conservation program at the University of Oslo, 2014

Questions and comments for this project will be most appreciated by the author



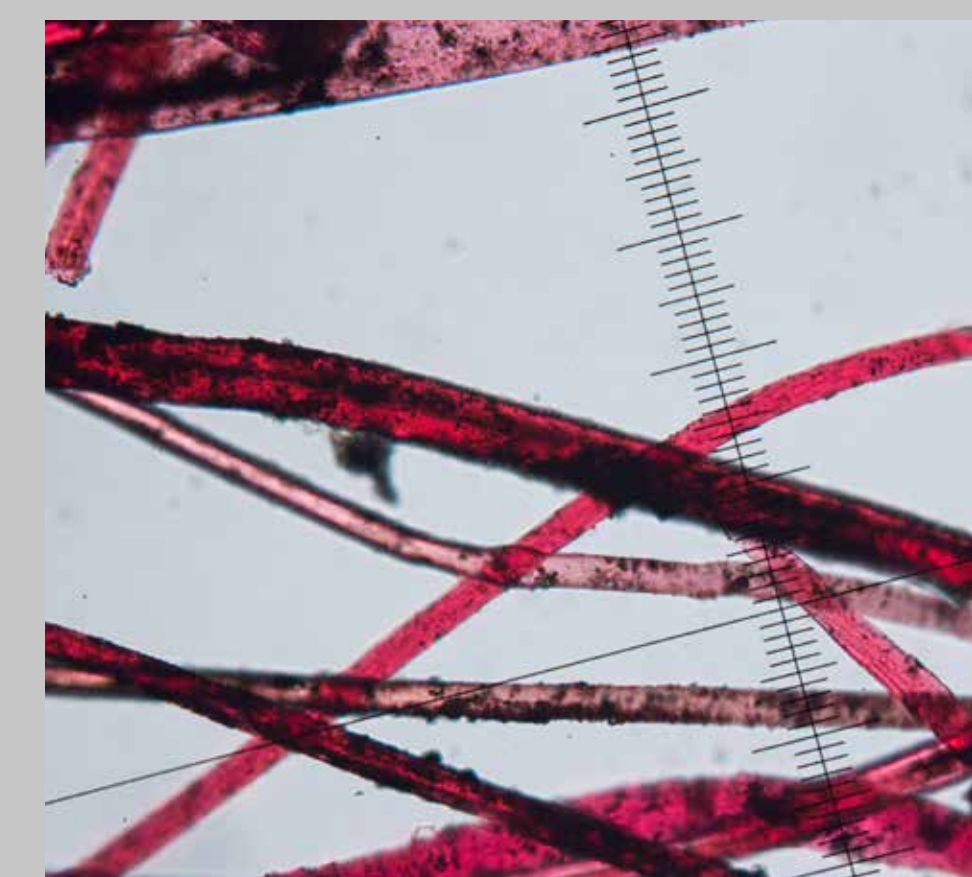
Before cleaning, x50 magnification



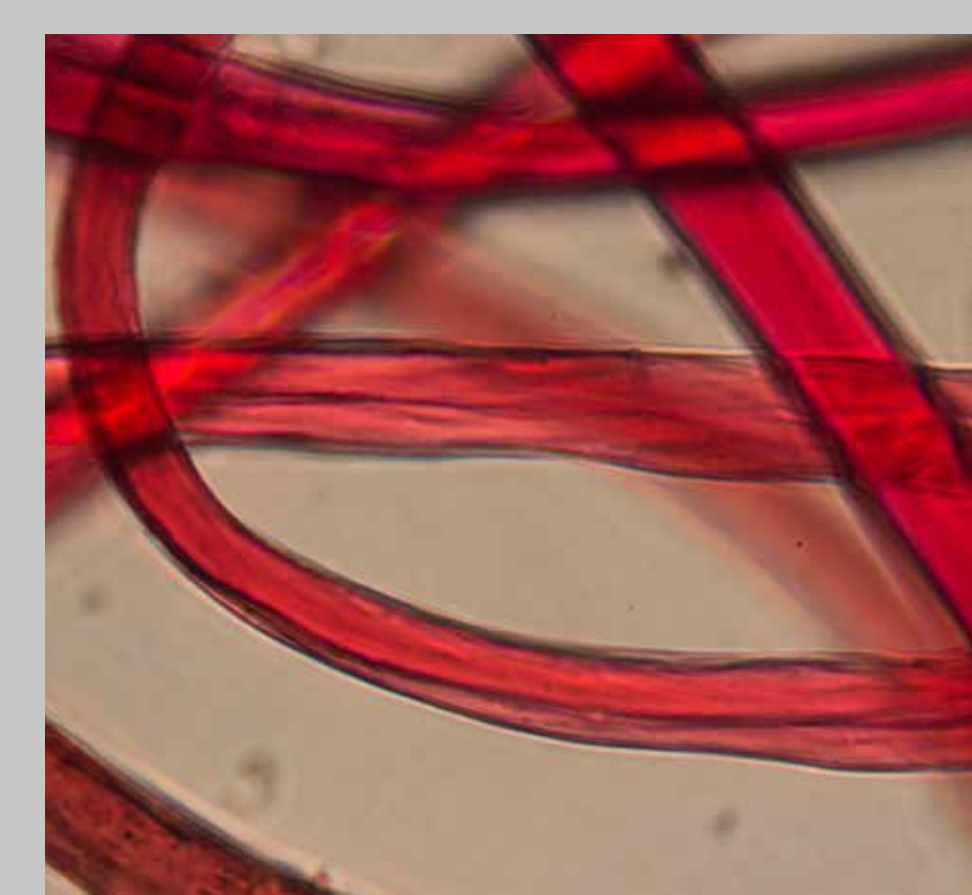
After cleaning, x50 magnification



Photos from the soot damaged process (Photo: Tor Linseth)



Before cleaning, x200 magnification



After cleaning, x200 magnification