Process Specific Control Summary

Mold Making - (Grinding and Polishing) Copper Beryllium Alloys

Purpose

This document has been developed to communicate the results of case studies performed on specific operations where copper beryllium (CuBe) alloys are processed and to provide the reader with information on exposure and exposure control options such as work practice, administrative and engineering controls.

Introduction

An airborne beryllium exposure assessment was conducted during mold making (grinding and polishing) of internal injection mold cavity surfaces containing CuBe Alloys. The intent of the study was to characterize worker exposure to airborne beryllium and identify work practice and local exhaust ventilation (LEV) controls necessary to reduce exposures to consistently below the beryllium industry's Recommended Exposure Guideline (REG).

Mold Making

Mold making consists of handheld grinding and polishing tasks on internal injection mold cavity surfaces. Operators use a variety of tools to accomplish their tasks including: hand stones, scotch bright pads, high speed electric sanders, pneumatic grinders, sanders, and lubricants. Wheel surface speeds used are variable and can be as high as 20,000 rpm.

Airborne Exposure Standards

BeST utilizes a Recommended Exposure Guideline (REG) of 0.6 µg/m^3 (inhalable sampling method) and 0.2 µg/m^3 (total-closed face filter cassette/CFC Total sampling method) which has proven effective when used in concert with the remaining elements of the Beryllium Worker Protection Model.

Baseline Exposure Evaluation

Seventeen (17) full shift exposure samples were collected in the breathing zone of operators performing work on internal injection mold cavity surfaces containing CuBe Alloy 25.

Personal Sample Results (CFC Total Method)

Number of Samples	Range µg/m^3	Percent Exceedance[1] at 0.2 µg/m^3	UTL$_{(95/95)}$[2] µg/m^3
17	0.012 - 0.900	43.5	2.62

[1]Percentage of exposures expected to exceed 0.2 µg/m^3 (comparable to 0.6 µg/m^{3}Inhalable). A percent exceedance of < 5% is considered to be "Well Controlled".

[2]Upper Tolerance Limit – one can be ninety-five-percent confidence that fewer than 5% of measurements are above the UTL(95/95)

Exposure Controls in use during Baseline Characterization

The benching stations in use at the start of this evaluation were equipped with a Dust Kop type dust collection unit. Some of the stations were equipped with a 6" flex duct on top of the benching table that could be positioned by the operator; two of the stations had "down draft" type tables.

- All of the Dust Kop ventilation units were powered by "on/off" switches located at the operator's work stations. The airflow provided by the existing Dust Kop ventilation units ranged from 310 to 777 cfm.

Exposure Characterization Summary - Evaluation Interpretations

- Airborne exposures to beryllium exceeding the REG for airborne beryllium were observed.

- Additional work practice and engineering controls, such as a redesign of the LEV capabilities, are necessary to improve particulate capture.

Exposure Control Improvements

The benching work stations were redesigned using the experience of benching operators, plant management and design criteria recommended by the American Conference of Industrial Hygienists® (ACGIH®) Industrial Ventilation Manual, 26th Edition. Details of the redesigned benching ventilation system are listed below:

Post Intervention Work Station

- To accommodate variability in production levels a centralized, variable frequency drive (VFD) Donaldson Torit dust collection system was installed.
- Partially enclosing style hoods were installed. These hoods were equipped with improved lighting to allow the operator better visibility, allowing the operator to work farther from the part.
- Hoods were designed with a top and sides to reduce the effects of cross-drafts created by room air currents.
- The hood was designed to be a combination of back draft and down draft slot hood. This style hood maximizes laminar air flow, significantly reduces the influence of eddies at the front of the hood (where the pieces are worked) and eliminates "dead" zones in the top of the hood.
- The design airflow rate for each hood was in the range 250 cfm per square foot of hood face area.
- Ductwork transport velocity target equals 4000 fpm.
- Each station is activated by a single power switch, turning on lighting, all pneumatic and electrical power, and opening the hood blast gate. Tools are interlocked to the ventilation system and will not operate unless blast gate is open.
- Removable plates make for easy cleaning of the downdraft hood drop-out plenum.
- The entire hood tilts to allow better access to the part.

Post Intervention Exposure Evaluation

Twenty-eight (28) full shift exposure samples, using the CFC Total method, were collected in the breathing zone of operators performing Benching on internal injection mold cavity surfaces containing CuBe Alloy 25.

Personal Sample Results (CFC Total Method)

Number of Samples	Range $\mu g/m^3$	Percent Exceedance[1] at 0.2 $\mu g/m^3$	$UTL_{(95/95)}$[2] $\mu g/m^3$
28	0.0084 - 0.0577	0.27%	0.088

[1]Percentage of exposures expected to exceed 0.2 $\mu g/m^3$ (comparable to 0.6 $\mu g/m^3$ Inhalable). A percent exceedance of < 5% is considered to be "Well Controlled".
[2]Upper Tolerance Limit – one can be ninety-five-percent confidence that fewer than 5% of measurements are above the UTL(95/95)

Additional Recommendations

- Implement the remaining elements of the Beryllium Worker Protection Model. Please review the Be Responsible Program at www.berylliumsafety.eu.
- Instruct operators to wear gloves when handling parts that are not visibly clean or are wet with coolant.

Cost Information

The upgrades to the local exhaust ventilation included the following: Purchase and installation of 35,000 cfm Donaldson Torit Downflow dust collector, with:

- Ultralock HEPA After filter return air system
- Abrasion resistant AR inlet
- Lined air plenum
- Bag-In/Bag-Out filter maintainability
- Tribo Flow particle detection
- Fabrication and installation of insulated ductwork
- Fabrication and installation of HEPA filtered recirculation loop.
- Fabrication of custom hoods

The approximate cost for this installation was $6.25/cfm.

Hood dimensions	54"x 30"x24" Open face 11.25 ft^2
Qhoodt	250 cfm/ft^2 x 11.25 ft^2 ---2813 cfm
Vslot	5 slots 52"x 0.75" – 1.354ft^2 Velocity = 2813 cfm/1.354 ft^2 2091 fpm
Benching Vdt	4000 fpm
Approximate Cost*	$15K

** This cost was derived from a project involving the installation of 10 benching hoods and engineering controls for a welding station and abrasive blasting operation.*

SUMMARY

OPERATIONS

Good work practices such as avoiding activities that result in airborne dust creation (dry cleaning or use of compressed air to remove particulate) and implementation of procedures for keeping the bench tops and floors clean and free of CuBe particulate accumulations are important methods for maintaining exposures reliably below the REG.

MAINTENANCE

Under certain conditions, the repair or maintenance of equipment can generate airborne particles. Protecting workers can require the use of specific work practices or procedures involving the combined use of ventilation, wet and vacuum cleaning methods, respiratory protection, decontamination, special protective clothing and when necessary, restricted work zones. Detailed procedures for safely maintaining the process equipment and ventilation systems should be

developed. All operators and maintenance personnel need to be trained in the established procedures prior to performing maintenance or service activities.

ADDITIONAL INFORMATION

The information contained in this document applies only to the subject referenced in the title. Read the SDS specific to the products in use at your facility for more detailed environmental, health and safety guidance.

The Be Responsible Program can be viewed at www.berylliumsafety.eu.

The foregoing is provided solely for informational purposes, based upon data believed to be correct and up to date, and is not to be construed as a warranty, express or implied, of any kind. The information above may not apply to a user's manufacturing operations; it is the responsibility of the user to determine safe conditions for the use of beryllium-containing products in its own operations and to comply with all applicable health and safety laws. Users of beryllium-containing products should not rely solely on this information to make decisions about exposure control, but should consult with experts who can evaluate the users' operations and make specific recommendations tailored to those operations.

Additional information may also be available by contacting:
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