MATERION

Safety Practices for Working with Aluminum Beryllium Products

AlBeMet®

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Aluminum beryllium composite (trade named AlBeMet®), in solid form and as contained in finished products, presents no special health risks. However, like many industrial materials, aluminum beryllium does present a health risk if handled improperly. The inhalation of beryllium dust, mist or fume can cause a serious lung condition in some individuals. The degree of hazard varies depending on the form of the product, and how the material is processed and handled. You must read the product specific Safety Data Sheet (SDS) for additional environmental, health and safety information before working with any beryllium-containing material.

In addition, processing aluminum beryllium composite shall be conducted in accordance with the Beryllium Standard for General Industry (29 CFR 1910.1024) established by the Occupational Safety and Health Administration (OSHA) which includes a Permissible Exposure Limits (PEL) of 0.2 microgram beryllium per cubic meter (0.2 µg/m^3) as an 8-hour Time Weighted Average (TWA), a Short-Term Exposure Limit (STEL) of 2.0 µg/m^3 determined over a 15-minute sampling period and ancillary requirements prompted at an Action Level (AL) of 0.1 µg/m^3 or other specified situations.

SOURCES OF EXPOSURE

All metal removal operations performed on aluminum beryllium products must be performed with appropriate work practices and engineering controls designed to control the release or generation of airborne beryllium-containing dust, mist or fume. The following table provides a summary of those processes that typically present low inhalation concern (green) and those that may present a likely inhalation hazard (yellow).

Low Inhalation Concern Operations	Likely Inhalation Hazard Operations			
Adhesive Bonding	Abrasive Blasting	Destructive Testing	Laser Welding	Sectioning
Anodizing	Abrasive Processing	Dicing	Laundering	Shearing
Assembly	Abrasive Sawing	Drawing	Machining	Sintering
Bending	Annealing	Drilling	Melting	Sizing
Electroless Plating	Atomizing	Dross Handling	Metallography	Skiving
Electroplating	Attritioning	Dry Tumbling	Milling	Slab Milling
Hand Solvent Cleaning	Blanking	Electrical Chemical	Mixing	Slitting
Handling	Bonding	Machining (ECM)	Photo-Etching	Solution
Inspection	Boring	Electrical Discharge	Physical Testing	Management
Packaging	Brazing	Machining (EDM)	Pickling	Spot Welding
Painting	Breaking	Electron Beam	Piercing	Sputtering
Plating	Bright Cleaning	Welding (EBW)	Pilger	Stamping
Radiography/X-ray	Broaching	Extrusion	Plasma Spray	Straightening
Shipping	Brushing	Filing by Hand	Point and Chamfer	Stretch Bend
Soldering	Buffing	Forging	Polishing	Leveling
Ultrasonic Cleaning	Burnishing	Grinding	Powder Handling	Stretcher Leveling
Ultrasonic Testing	Casting	Gun Drilling	Powder Pressing	Tapping
	Centerless grinding	Heading	Pressing	Tensile Testing
	Chemical Cleaning	Heat Treating (inert	Process Ventilation	Thin-Film Deposition
	Chemical Etching	atmosphere)	Maintenance	Thread Rolling
	Chemical Milling	Heat Treating (in air)	Reaming	Torch Cutting (i.e.,
	CNC Machining	High Speed Machining	Resistance Welding	oxy-acetylene)
	Cold Forging	(>10,000 rpm)	Ring Forging	Trepanning
	Cold Heading	Honing	Ring Rolling	Tumbling
	Cold Isostatic Pressing	Hot Forging	Riveting	Turning
	(CIP)	Hot Isostatic Pressing	Roll Bonding	Upsetting
	Cold Pilger	(HIP)	Roller Burnishing	Vapor Deposition
	Cold Rolling	Hot Rolling	Rolling	Water-jet Cutting
	Coolant Management	Investment Casting	Rotary forging	Welding (ARC, TIG,
	Crushing	Lapping	Sand Blasting	MIG, etc.)
	Cutting	Laser Cutting	Sand Casting	Wire Electrical
	Deburring (grinding)	Laser Machining	Sanding	Discharge Machining
	Deburring (non-grinding)	Laser Scribing	Sawing (tooth blade)	(WEDM)
	Deep Hole Drilling	Laser Marking	Scrap Management	

Notes:

1. Operations in the "Low Inhalation Concern" category represent operations that typically release non-respirable (>10 micrometer) particles, are not expected to generate significant ultra-fine particulate, and/or are not expected to result in exposures in excess of the OSHA PEL.
2. Operations in the "Likely Inhalation Hazard" category represent those operations which may release respirable (<10 micrometer) particles, may generate ultra-fine particulate, may generate beryllium oxide and/or may result in exposures in excess of the OSHA PEL.
3. This list is not all-inclusive and variation can exist within specific processes. Determine, then verify, the adequacy of engineering and work practice controls by conducting an exposure characterization of all copper beryllium processing operations.
4. Effective ventilation, work practices and personal protective equipment use can control a "Likely Inhalation Hazard".
5. When evaluating operations, consideration must be given to potential exposures from activities in support of these operations such as setup, preparation, cleanup and maintenance.

WORK PRACTICES AND CONTROL MEASURES

The following exposure control measures must be considered for particle producing operations involving aluminum beryllium products:

Wet Methods

- Machining operations are usually performed under a liquid coolant flood which assists in reducing airborne particle dispersion. However, the process may also require complete hooded containment and local exhaust ventilation (see exhaust ventilation section below).
- Care must be given to lubricant containment which prevents splashing onto floor areas, external structures or operators' clothing.
- Coolant splash which does deposit outside the ventilated enclosure should be cleaned up immediately. Splashed coolant must not be allowed to dry because it may carry with it particulate containing beryllium which can later become airborne.
- Cycling of liquid machining lubricant/coolant containing finely divided beryllium in suspension can result in the particle concentration building to a point where beryllium may become airborne during use.
- The coolant reservoir should be enclosed and ventilated.
- A coolant filtering system is recommended.

Exhaust Ventilation

- Local exhaust ventilation with full enclosure hooding must be used on all machining operations capable of producing airborne beryllium dust, mist or fume.
- The type of ventilation required depends on the characteristics of particle generation. Particulate generation can be highly variable as determined by feed rate, feed speed, size and speed of the tooling, tool sharpness, coolant flow, configuration of the part being machined, etc.
- The hooding should completely enclose the "point of operation" area without interfering with the travel of machining tooling. The enclosure should have no openings which would allow direct release of airborne particulate outside the enclosure. Any opening within the normal range of direct particle/coolant scatter should be baffled or convoluted in design to prevent a direct release outside the enclosure.
- Enclosure doors should be interlocked to the machine controls. If the doors are opened, the machine should stop automatically.
- Ventilation systems should be interlocked to the machines in a manner which requires the ventilation to be operating before or concurrent to the startup of the machines.
- Dry machining of aluminum beryllium requires a close capture, high velocity, low volume ventilation system. High velocity/low volume ventilation pick-ups must be located as close to the point of particulate release as possible and be positioned "in-line" with the direction of particle generation. Where necessary, custom fabricated ventilation duct inlets should be provided to optimize capture of chips and particulate released by particle producing processes. In addition to having a close capture ventilation system, a secondary total enclosure may be necessary when dry machining aluminum beryllium.
- The particles generated when using powered grinders or roto tools can be very difficult to control due to the random nature of particle generation. The use of powered grinders and roto tools must be controlled in a ventilated partial or complete enclosure designed to draw particles away from the operator.
- Alternative methods to powered grinders such as wet filing or wet hand sanding should be used where possible.
- Dry hand sanding or filing of aluminum beryllium must either be performed inside a ventilated enclosure or performed completely wetted or submerged. Parts and other contact materials must be cleaned before removing from the ventilated enclosure or immediately after wet processing. Compressed air must not be used to clean parts. Residue on tooling and contact materials must not be permitted to dry and should be cleaned and/or double bagged in a moist condition to prevent airborne exposure during subsequent handling.
- Disruption of the airflow in the area of a local exhaust inlet, such as by a man cooling fan, should be avoided.
- The discharge of air from an air cleaning system into the work place air is not recommended due to the potential for exposure in case there is a failure of the filtration system. The system should be discharged outside and away from building makeup air inlets.
- Most process air emission sources will require an air permit from a local and/or state air pollution control agency.

The use of air cleaning equipment may be necessary to achieve the permissible emission. Tempered makeup air should be provided to prevent excessive negative pressure in a building. See the Safety Data Sheet (SDS) for detailed information on air emission requirements.

- Ventilation equipment should be checked regularly to ensure it is functioning properly. Ventilation training is recommended for all users. To be effective, the ventilation system should be designed, installed and maintained by qualified personnel.

Tooling

- During machining of aluminum beryllium products, the tooling may become contaminated to a point where subsequent conditioning and sharpening activities may need special controls and work practices.
- Tooling used to machine aluminum beryllium should be dedicated to the activity or should be cleaned prior to use in other areas or on other materials.
- All tooling should be cleaned immediately after removal from a machine by wet cleaning methods to ensure no loose particulate remains on the tooling.
- Consideration for a potential exposure to airborne beryllium must be given when tooling is to be sharpened. Emissions from sharpening can be best controlled by utilizing appropriate close capture ventilation or by machining under a coolant flood of sufficient flow to control airborne particulate.
- If tooling is sent out for sharpening, the service provider should be provided a copy of the SDS and warned in writing of the potential for exposure to beryllium.

Workplace Exposure Characterization

- Air samples should be taken for all operations where a potential for beryllium exposure exists.
- Air monitoring is the primary method for determining the degree of exposure and effectiveness of engineering and work practice controls.
- Characterization of worker exposure should only be performed by trained personnel.

Respiratory Protection

- Whenever possible, appropriate work practices, use of local exhaust ventilation or other engineering controls are the preferred methods for controlling exposure to airborne particles. When these methods are ineffective or are being developed and potential exposures are above the occupational limits, approved respirators must be used as specified by an Industrial Hygienist or other qualified professional, and in compliance with the Respiratory Protection Standard (29 CFR 1910.134) established by OSHA.
- Respirator users must be medically evaluated to determine if they are physically capable of wearing a respirator.
- Quantitative and/or qualitative fit testing and respirator training must be satisfactorily completed by all personnel prior to respirator use.
- Users of any style respirator must be clean shaven on those areas of the face where the respirator seal contacts the face.
- Pressure-demand airline respirators are required when performing jobs where a potential for high exposure exists, such as changing filters in a baghouse air cleaning device.

Protective Clothing and Personal Hygiene

- Company-supplied work clothing and/or disposable over garments must be worn if the job or work activity includes the potential for contamination of personal clothing (gloves, shirts, pants, boots) with beryllium dust, mist, fume or powders.
- Work practices and procedures should be developed to prevent beryllium particles from coming in contact with worker's skin or hair. Workers who may come in contact with beryllium particles must be provided with appropriate hand, skin and hair washing facilities.
- Procedures should be written to clearly communicate the facility's requirements for protective clothing and personal hygiene. These clothing requirements help keep beryllium-containing particles from being spread to non-production areas or from being taken home by the worker.
- Used disposable clothing should be containerized and disposed of in a manner which prevents airborne exposure during subsequent handling activities.
- Contaminated work clothing and overgarments must be managed in such a manner to prevent secondary airborne exposure to family or laundry personnel handling soiled work clothing.
- If a laundry service is used, soiled clothing should be properly containerized. The laundry should be warned in writing about the aforementioned precautions and they should be provided an aluminum beryllium SDS.
- Never use compressed air to clean work clothing.

Housekeeping

- Aluminum beryllium processing equipment and associated support systems (e.g. dust collectors, heat treat furnaces, coolant trays and reservoirs) should be cleaned on a regular basis to prevent the accumulation of any beryllium-containing materials.
- Floors and walls should be cleaned frequently so no visible accumulation of dirt or debris is apparent.
- Brooms must not be used in the aluminum beryllium work area. They can cause airborne exposures as a result of the sweeping action.

- The use of compressed air or brooms for cleaning dust must be prohibited because such activity can result in unnecessary airborne dust exposure.
- Wet cleaning and HEPA vacuuming are effective methods for cleaning machining and support equipment.
- Portable vacuums should be of a type equipped with High Efficiency Particulate Air (HEPA) rated filters.
- The floors and walls should have an easy to clean finish to facilitate housekeeping.
- After machining, parts should be HEPA vacuumed or rinsed with coolant. Parts should be wet wiped clean.
- Rags or towels used to dry or wipe parts clean should not be allowed to dry and must be maintained in a closed container. Used rags and towels should be containerized and disposed of in a manner which prevents airborne exposure during subsequently handling activities.
- The use of reusable rags is not recommended. If an outside service is used, the rags should be properly containerized. The laundry should be warned in writing about the aforementioned precautions and they should be provided an aluminum beryllium SDS.

Maintenance

- Under certain conditions the repair or maintenance of equipment can generate airborne particles. Under these circumstances, protecting workers can require the use of specific work practices or procedures involving the combined use of ventilation, wet vacuum cleaning methods, respiratory protection, decontamination, special protective clothing, and when necessary, restricted work zones.
- Beryllium-contaminated equipment should be thoroughly cleaned prior to performing service and maintenance.
- Beryllium-containing residue may deposit on the internal surfaces of ventilation enclosures and equipment structures. The residue must be removed, kept wet or otherwise controlled during maintenance and service activities to minimize airborne generation or particles.
- 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. The procedure should detail the use of wet methods or vacuuming, ventilation and appropriate personal protective equipment required to prevent exposure to airborne particles.

Recycling

- Aluminum beryllium scrap should be kept segregated from other metals because of its higher value as a recyclable material. Materion Brush Inc. purchases clean, segregated aluminum beryllium scrap (routine amounts of lubricant are not a problem) at a premium above mixed metal alloys.

Disposal

- Aluminum beryllium wastes are not considered hazardous under federal regulations. When spent products are declared solid wastes (no longer recyclable), they must be labeled, managed and disposed of, in accordance with federal, state and local requirements.

ADDITIONAL INFORMATION

The information contained in this Safety Facts 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. SDSs can be obtained by contacting the Materion Brush Inc. Product Safety Hotline at (800) 862-4118 or visit our websites at www.materion.com.

Additional information can also be obtained by contacting a Materion Brush Inc. Sales Representative or:

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