Name of SOP	Melting
Effective Date	June 11, 2008
Author	Dr. Peyman Ashtari
Reason for SOP	Check All that Apply: [x] Procedure/Process could cause critical injury. [x] Procedure/Process could cause occupational illness. [ ] Procedure/Process could cause environmental impairment. [x] Procedure/Process could damage University property. [ ] Supervisor's discretion. Provide Details:
Approved by (supervisor)	Dr. Sumanth Shankar
Date reviewed by JHSC	June 11, 2008

Definitions

Terms	
Acronyms	RMM – Risk Management Manual JHSC - Joint Health and Safety Committee EOHSS - Environmental and Occupational Health Support Services EPA – Environmental Protection Act OHSA – Occupational Health and Safety Act LMCRC: Light Metal Casting Research Center PPE: Personal Protection Equipment

Requirements

Applicable OHSA regulations and / or codes of practice.

1. RMM #101 - McMaster University Risk Management System

Training and Competency

1. Training provided by LMCRC
2. Competency is shown by the individual after training

Description of the Task

Location and time of work	JHE-101 during normal working hours
Individuals involved	Graduate Students, Post Doctoral Fellows
Equipment and supplies required	Electric Resistance Furnace, Crucibles, Tongs, Moulds, Skimmers and other melting tools
Personal protective equipment required	Lab coats, heat resistant gloves, face shields, spats, and steel-toe-shoes

Sequential Steps to Complete the Work Safely

General warnings

1. Ingots, raw materials and moulds must be dry before use. They should be preheated in order to

dry.
2. Use the specific heat resistant gloves that are provided in the Lab.
3. Read the MSDS sheets for the materials you wish to melt or will be adding to the melt.
4. In case of repairing the furnace, follow the lock out/tag out procedures (RMM#306).

Melting and casting steps

1. Wear proper PPE mentioned above. Also, people who help during casting must wear PPE.
2. Calculate the amount of the materials you wish to melt.
3. Cut the ingots and weigh the amount of the raw material that you need.
4. Inspect the crucible you plan to use for any fracture or crack. Make sure that the crucible is coated to avoid sticking the molten metal to it. Read the MSDS of the coating material and take proper precautions to apply the coating.
5. Make sure that the crucible coating is completely dried before use.
6. Clean and dry the ingots and raw materials.
7. Load the raw materials in the crucible and put in the furnace.
8. Turn on the furnace and adjust the required temperature. Read the SOP of the furnace before use. Post warning sings that indicate the furnace is operating and it is hot.
9. Make sure that the mold is dry and in a safe area for casting, equipped with spill kits. Post warning signs to indicate that the mold is hot.
10. After the required temperature is obtained in the furnace, check the molten metal condition. **Wear proper PPE.**
11. Stir the melt using a proper tool and skim the dross.
12. Pour the melt into the mold. Return the crucible into the furnace to save it for the next casting or empty it in the ingot moulds. Make sure that the ingot molds are dry before pouring.
13. Give sufficient time to solidify the melt inside the mold. Open the mold and take the cast part out. Remember that the part is hot! Only use tongs to put it in a safe area to cool down. Post warning signs to indicate that the part is hot.
14. Shut down the furnace, clean the area and tidy up.
15. Remove the warning sign after the furnace, mold, cast parts and tools are cooled to the room temperature.

Contingency Plan and Reporting

Accident / injury response

1. Take the injured person to first aid station.
2. Notify Mechanical Engineering technical staff immediately.
3. For all injuries complete a “Injury/Incident Report” and provide a copy to the Chair and EOHSS

In the Case of Serious/Critical Injuries

1. Call emergency (DIAL 88).
2. Notify EOHSS immediately, ext 24352.

Risk of explosion

Precautions to prevent an explosion:

1. No food or drink should be allowed in the lab. Accidental contact of a liquid (e.g. water, coffee) with melt will result in an explosion. If an empty can accidentally enters the furnace, it will explode.
2. Dry the raw materials before loading them into the furnace.
3. Skimmers and other melting tools must be dry before use.
4. The mold should be clean and dry before pouring the melt into it.

In case of explosion of the melt or spill:

1. Stop casting.
2. Turn off the power of the furnace.
3. Warn people to clear the area. (Molten metal on the floor can burn people).
4. In case of fire, call emergency (dial 88). If possible, use fire extinguisher.

5. If somebody is injured, take her/him to the first aid station. In case of serious injury, call emergency (dial 88).
6. The molten metal spilled on the floor may solidify soon, but it is still hot. Use tongs to remove.

Fracture of crucible

Crucibles should be inspected carefully before use. The crucible should be without cracks, thin spots, flaws or dampness.

In case of fracture of crucible and flow of the molten metal in the furnace:
1. Turn off the power of the furnace.
2. Do not touch the melt before it solidifies.
3. Do not clean the furnace until it is completely cooled to room temperature.

Equipment Malfunction

Shut down the furnace and contact technical staff.

Equipment shutdowns

Turn off the main switch and the breaker.

Environmental Responsibility

Waste disposal procedures

There are some metal wastes produced by the experiments. Put them in the metal recycling containers.

Building air quality

Ensure that the ventilation fan is on during the melting and casting.

References

1. OHSA/ regulations
2. EPA and Municipal environmental regulations
3. RMM #100 McMaster University Environmental Health and Safety Policy
4. Material Safety Data Sheets (MSDS)
5. RMM #300 Safety Orientation and Training Program
6. RMM #301 Standard Operating Procedures
7. RMM Policy #304 Persons Working Alone
8. RMM Policy#306 Lock out/tag out
9. RMM Policy #309 Laboratory Safety Manual
10. RMM Policy #310 Eye Protection.
11. RMM Policy #311 Respiratory Protection
12. RMM Policy #312 Foot protection
13. RMM Policy #313 Head protection
14. RMM Policy #316 Electrical Safety
15. RMM Policy #321 Hand protection
16. RMM Policy #403 Noise Control and Hearing Preservation
17. RMM Policy #1000 Reporting and Investigating Injury, Incidents and Occupational Diseas

Distribution

1. Supervisor
2. Trained teaching assistant who is the lab operator
3. Technical Staff of Mechanical Engineering
1. Faculty of Engineering JHSC