Name of SOP	Dissolution of Al alloys
Effective Date	July 15, 2013
Author	Jeyakumar Manickaraj
Reason for SOP Safety of the operator, people around and equipment	Check All that Apply: [X] Procedure/Process could cause critical injury. [X] Procedure/Process could cause occupational illness. [ ] Procedure/Process could cause environmental impairment. [ ] Procedure/Process could damage University property. [ ] Supervisor's discretion. Solvents are **Highly Toxic and Flammable**. Read MSDS before starting procedure.
Approved by (supervisor)	Dr. Sumanth Shankar
Date reviewed by JHSC	July 10, 2013

Definitions

Terms	none
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

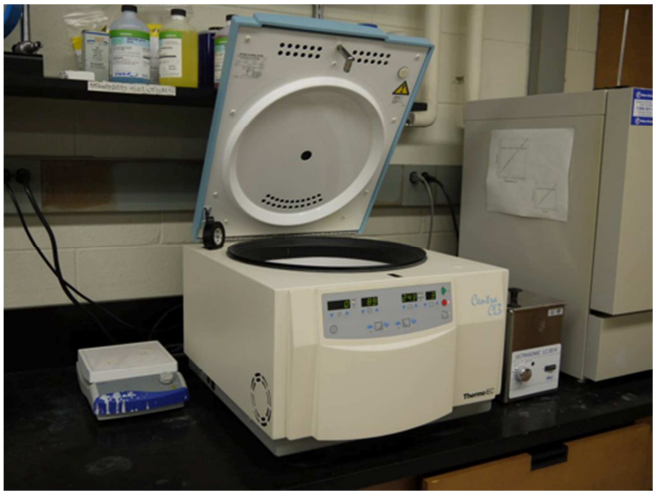
Requirements

Applicable OHSA regulations and / or codes of practice. 1. RMM #101 - McMaster University Risk Management System
Training and Competency 1. Training provided by Light Metal Casting Research Center (LMCRC) and graduate students who operate the facility. 2. Competency is shown by the individual after training

Description of the Task

Location and time of work	**JHE A202**
Individuals involved	Graduate Students with adequate training as defined above. PDFs
Equipment and supplies required	Doubled wall condenser, Electric heater, Centrifuge, Phenol, Benzyl Alcohol, Toluene, Ethanol
Personal protective equipment required	Safety Goggles, face shield, Lab coats, chemical resistant gloves (as per MSDS for Phenol), Closed-toe shoes with socks, fume hood ,ventilation

Dissolution setup



Centrifuge apparatus

General safety instructions

1. **Check fume hood functions every time you start procedure**
2. **Nitrile glove will withstand occasional splash but for prolonged exposure use only chemically resistant gloves**
3. **Read the MSDS for the solvents (Phenol, Toluene and Benzyl Alcohol)**
4. Use personal Protective Equipment throughout the dissolution process: face shield if not wearing goggles, chemical resistant gloves to resist phenol and laboratory coat.
5. Wear proper gloves while working or operating at high temperatures
6. Use the chemicals inside the fume hood

Part I: Melting Phenol

1. Keep the phenol in the water bath
2. Heat the water using heater at around 363 K (90 ºC)
3. Around 80 ml of phenol is required to dissolve 3 g of Al alloy
4. Crystallized phenol is melted in a water bath maintained at around 363 K (90 ºC) and kept under a closed fume hood. 60 to 80 ml of liquid phenol is recommended for 3 g of the Al alloy

Part II: dissolution of Al alloys with Phenol
(following steps are carried out inside the fume hood)

1. Pour the phenol in the three headed glass flask (shown in dissolution setup)
2. Switch on the electric heater and set the temperature around 454.7 K (181.7 ºC)
3. Keep the phenol in that temperature for 30 min. to clean the phenol
4. After 30 min. switch OFF the heater and then add the sample flakes (Al alloy) to the phenol
5. Switch ON the heater and set the temperature around 454.7 K (181.7 ºC)
6. It would take around 40 min to dissolve the Al alloy sample
7. Switch OFF the heater
8. Add the mixture of 80 ml Benzyl Alcohol and 20 ml Toluene to the phenol
9. Wait for around 30 min. until the entire mixture in the three headed flask is cooled to room temperature

Part III: Centrifuge apparatus – Use to separate the undissolved powder from the solution

1. Transfer the mixture into several small plastic tubes that are to be loaded into a centrifuge device. **All procedures should be performed inside fume hood** (Make sure plastic tube you are using is compatible with Benzyl Alcohol as this stuff is corrosive)
2. Program the controller in the centrifuge apparatus as per your experiment design
3. The centrifuge operation is carried out in three to four cycles
4. Each cycle lasts from about 90 min at 3000 RPM
5. After each cycle, the solid sediments at the bottom of each plastic tube is separated from the liquid on top through decantation
6. A solution mixture of 60 ml Benzyl Alcohol and 40 ml Toluene is added to the solid sediment prior to the second stage of centrifuging
7. A solution mixture of 10 ml Benzyl Alcohol and 90 ml Toluene is added to the solid sediment prior to the third stage of centrifuging
8. The last centrifuge cycle is carried out by filling the plastic tubes with the solid sediments with anhydrous Ethyl Alcohol
9. The final solid sediment obtained after decantation of Ethyl Alcohol mixture is transferred to a glass beaker and dried in an oven at 348 K (75 ºC)

Contingency Plan and Reporting

Equipment Malfunction

If there is any problem in the fume hood , Switch OFF the heater and vacate that place
If centrifuge is malfunctioned - turn off centrifuge remove samples from centrifuge and dispose samples.

Chemical spills

1. Eliminate sources of ignition
2. Do not try to approach spill without proper respiratory protection (N100 certified or better) and

chemically resistant gloves
3. Alert others working in laboratory. Keep people out of the immediate area
4. Establish barriers if the spill has occurred in public passageways
5. If unsure how to proceed seek help (call security (dial 88)).
6. The person cleaning up the spill should wear a respirator and gloves (as per MSDS)
7. Transfer the material containing the spill to a plastic container and carry to a fume-hood for later disposal. Allow fumes to evaporate in the fume-hood overnight or over a weekend
8. If the residual waste is hazardous, package all contaminated material in a suitable container, attach a label and submit for waste disposal

Accident / injury response

1. Apply first aid as required in case of contact with chemicals wash affected area with tap water for 5 minutes immediately
2. Notify Materials Science and Engineering Technical staff and principal investigator immediately, ext 24106.
3. For all injuries complete a "Injury/Incident Report" and provide a copy to the Chair and EOHSS

In the Case of Critical Injuries

1. Shutdown equipment and secure the area to prevent further injury and accident investigation
2. Immediately arrange for medical and emergency assistance by calling Security at ext. "88".
3. Apply first aid as required
4. Notify EOHSS immediately, ext 24352
5. Notify Materials Science and Engineering Technical Staff immediately. Ext. 24106
6. Notify supervisor

For all injuries complete a "Injury/Incident Report" and provide a copy to the Chair and EOHSS

Environmental Responsibility

Waste disposal procedures

Place organic solvent wastes into clearly labeled, appropriate containers for Hazardous waste disposal.

Building air quality

Procedure does not affect air quality

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 #304 persons Working Alone
8. RMM #309 Laboratory safety manual
9. RMM #310 Eye Protection Program

Distribution

1. Faculty of Engineering JHSC (for review)
2. Technical Staff of Mechanical Engineering JHE 205 ext. 24628
3. Mechanical Engineering Archive of SOP's
4. JHE 101
5. Materials Science and Engineering