הטכניון TECHNION Israel Institute of Technology
מכון טכנולוגי לישראל

A Safety Moment

מידע מיחידת הבטיחות | יולי 2020

יחידת הבטיחות
SAFETY UNIT

Tel: 04-8292147 | tsafety@technion.ac.il | https://safety.net.technion.ac.il/

Information from the Safety Unit | July 2020

Safe soldering

In labs and in many workshops on the campus as well as at home we use desktop soldering irons and tin solder. The soldering process involves health and environmental hazards.

Following are several safety recommendations concerning the soldering process that should be implemented at work and at home.

- The "traditional" soldering tin is a mixture of the elements tin (Sn) and lead (Pb) at various concentrations, usually at a ratio of about 60/40 with the addition of a flux core , a mild acid that cleans the surface and ensures better metals connection. Tin and lead are metals with a relative low melting point and the combination of the two gives the tin solder the desired characteristics of strength, hardening speed and more.
- But, lead is toxic and damages the environment as well, for example: when old electronic components are dumped into the garbage, therefore modern standards in many industry domains require the use of lead free tin.
- The manual soldering process using materials of the tin-lead type is likely to expose the worker to lead. The lead penetrates into the body through the respiratory system and the digestive system. The respiratory system is exposed to metal vapors in the absence of ventilation in the workplace. The exposure of the digestive system occurs when the environment is not clean, for example lack of awareness to hand hygiene after soldering, so that lead enters the body by drinking, eating and smoking with hands contaminated with lead that come close to mouth or nose.
- Lead has toxic effects on various body systems. In the digestive system can occur strong contractions of the bowels accompanied by constipation; in the blood system the lead leads to the development of anemia; there is also damage to the central nervous system and to kidney functions.
- Poisoning during exposure to "soldering fumes" is caused as well by a mixture of materials (among them resin acids found in the flux) known as causing occupational asthma and allergic dermatitis.
- During manual soldering the worker is exposed to the decomposition products of the flux since he breathes close to the "soldering fumes".
- The use of products that contain resin fluxs must be reduced and limited.

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- Lead monitoring tests conducted near soldering stations in various labs of the faculties and workshops on the campus, detected values 20 and 50 folds higher than recommended.

THEREFORE, THE SAFETY UNIT HAS PUBLISHED THE FOLLOWING GUIDELINES:

1. It is recommended to start working with lead free solders.
2. Work with products that contain resin fluxes must be limited.
3. Work must be done in the presence of suction systems
4. The work stations must be located away from flammable materials
5. It must be possible to clean the work environment on work completion
6. Do not carry out soldering works while wearing contact lenses!!
7. It is absolutely forbidden to eat and drink in the lab.
8. Wash hands frequently: before and after breaks and eating and at the end of the work day.
9. Always use tissues (disposable)! and paper wipes at the soldering station.
10. Wear adequate personal protective equipment: long sleeved and closed coat, long trousers and closed shoes.

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TO LIVE WITH AND "BE CAREFUL OF "-
THE LITHIUM ION BATTERIES FAMILY

During the last years we hear of more and more occasions when lithium batteries caught fire and caused huge damages to property and physical damage to people. In addition, we hear from time to time about products that were recalled due to ignition hazards, starting with Dell laptops in 2006 to Samsung Galaxy Note 7 in 2016. Another incident that was widely published during 2012 – 2013 was the Boeing 787 planes grounding due to a fire and smoke incident that occurred in the lithium-ion batteries installed on the planes. In spite of the above, the use of this batteries family is more and more common.

- **What are the lithium-ion batteries and what is their advantage?** Those are rechargeable batteries where lithium ions move between electrodes. They are called lithium-ion in order to differentiate them from lithium-metal batteries where the anode is made of lithium metal and the battery cannot be recharged. This technology was developed by John Goodenough, Stanley Whittingham, Rachid Yazami, and Koichi Mizushima. Three of them were granted the Nobel Prize in Chemistry.
- **What are the advantages of these batteries**? The energy density of the lithium-ion batteries is high, the number of charge/ discharge cycles is high and the capacity loss during recycling is low. The battery weight/ received energy ratio is low; therefore it is suitable to aerial vehicles such as drones.
- **Which devices use lithium-ion batteries?** Mobile electronic devices such as phones and computers, chargeable vehicles, such as electric bicycles, skateboards, vacuum cleaners, model airplanes, drones and electric cars
- **What are the hazards associated with lithium-ion batteries?** In cases of overcharging, over discharge, fast charging, overheating, shortcut or mechanical defect these batteries can ignite or explode. Over the years and due to the expansion of the use of such batteries, protection mechanisms against overheating and structural failures have been developed. For example, development of ventilation systems to prevent overheating and systems to prevent overcharging, so that today, despite the widespread use of these batteries on many devices, failures in these batteries occur in only a small percentage of cases.
- **How to put out a lithium-ion battery fire**? A lithium-ion battery fire can be handled by many extinguishing means, since it is not made of lithium metal, which requires a dedicated extinguishing agent. It is therefore possible to handle a lithium-ion battery fire with the help of a foam extinguisher, CO2, dry powder (Red extinguishers on campus). Do not try to extinguish the lithium-ion battery fire with water, for fear of a possible reaction that might exacerbate the situation. On the contrary, **a lithium-metal battery** should be extinguished

with the help of a dedicated metal fire extinguisher, a yellow fire extinguisher. It is very important to differentiate between the two cases and carry out the work respectively.

- **Is there a limit on shipping lithium-ion batteries by air?** The International Air Transport Association (IATA) has issued guidelines that limit the shipping of lithium-ion batteries by air that differentiate between batteries shipped as cargo and batteries installed in equipment. In addition, the airlines differentiate between lithium-ion batteries carried in hand luggage and batteries included in the cargo. Instructions for carrying lithium-ion batteries in hand luggage are more permissive since it is possible to watch the product.
- **Precautions when using lithium-ion batteries according to the Firefighting and Rescue Authority:**
    - Buy only lithium-ion batteries with standard mark
    - Do not charge batteries unattended
    - Do not make structural changes in the battery
    - Do not charge the battery near flammable materials
    - Avoid overcharging: disconnect the battery when it reaches 100%.
- **Instructions for handling LiPo batteries at the Technion:**

Lithium-polymer batteries are in use at the Technion in labs that operate drones. The risk of ignition of these batteries during use, charging and storage must be taken into consideration. Attached is the instructions document for the use of LIPO batteries from the Safety Unit site, prepared in coordination with the users on campus – instructions on the safety site.

Handing of those batteries at the Technion requires information about the battery, the number of cells and the charge, with emphasis on the charging and storage plan. In addition, the storage location must be considered in order to prevent fire spread.

Bags that prevent fire spread (Lipo Battery Safety Bag Fire Retardant Fireproof Explosion Proof Guard) are available on the market. Labs that use these batteries are requested to contact the Faculty Safety Responsible in order to receive instructions on the subject.

Disposal of lithium-ion batteries

All batteries types at the Technion, including lithium-ion batteries are disposed of by the company Ecommunity. Until lately, collection was done through the general warehouse. The current procedure enables collection from each Technion building separately. To coordinate the collection, the building responsible, or his representative, must contact the company.

Ecommunity (050-3597966 – contact person: Hagit). If disposal of lithium-ion batteries is required, this must be mentioned in advance.