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Construction Dept. 校园建设部	√	Logistics Dept. 校园后勤部	√	EHS office 校园办公室	√
RIGS 研究创新和研究生部	√	U.G. Dept. 本科教学部	√	I.T.Dept. 电脑信息部	√

Relevant documents 相关文件

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1. Purpose 目的

In order to further strengthen laboratory safety management, strengthen students 'awareness of laboratory safety, health and environmental protection responsibilities, prevent and reduce accidents, ensure the normal and orderly operation of the laboratory, and ensure the safety of teachers, students, employees, and laboratory property, this system has been formulated.

为进一步加强实验室安全管理，强化学生的实验室安全健康和环境保护责任意识，防止和减少事故发生，保障实验室正常有序运行，确保师生、员工生命与实验室财产安全，特制定本制度。

2. Scope of application 适用范围

It applies to the safe management of all 3D printing equipment in GTIIT.

适用于本校所有 3D 打印设备的安全管理。

3. Responsibility 职责

3.1. EHS office 安全办公室

- Provide appropriate safety advice for the management of laboratory safety access systems.

  为实验设备安全准入提供相应安全咨询。

- After completing the lab renovation, conduct the safety review for lab acceptance and continuous improving

  设备安装后，协助实验室进行安全条件检查和跟进后续改善工作。

- Provide the general safety training.

  为实验室提供一般安全培训。

- Responsible for overseeing the effective implementation of safety management of laboratory facilities and

equipment.

负责监督实验室设施设备的安全管理工作的有效落实。

3.2. Campus Construction Department 校园建设部

- Collect the lab and experiment information with lab PI

  实验室准入信息收集 CCD 负责和实验室 PI 沟通需求和要求

- Responsible for completing the installation of equipment supporting utilities according to the initial laboratory design requirements, such as the exhaust gas collection system for 3D printers and the setup of heat and light insulation facilities.

  负责完成根据初始实验室设计要求的设备配套公共设施安装工作，如 3D 打印机的废气收集系统、隔热遮光设施设置等。

- After completing the lab renovation, CCD will complete the acceptance for construction and continuous improving

  实验室装修完工后，建设部负责项目装修验收和改善工作。

3.3. Campus Logistics Department 校园后勤部

- Upon completion of the laboratory renovation, the Logistics Department will assist the laboratory in completing the installation and commissioning of laboratory equipment and acceptance in accordance with the initial design requirements.

  实验室装修完工后，后勤部将协助实验室根据初始设计要求完成实验设备的安装和调试、验收工作。

- Assist in the completion of fixed asset registers for laboratory equipment and facilities.

  协助完成实验室设备设施的固定资产登记。

3.4. Onsite safety representative of Programs 各学科安全代表：

- Responsible for the safety related management and duties of the laboratory;

  负责本学科实验室安全相关管理工作和职责；

- Determine that the heads and faculty of the subject laboratory have laboratory safety management capabilities.

  确定学科实验室负责人和教员具备实验室安全管理能力。

- Provide resources for laboratory safety training.

  为实验室安全培训提供资源。

- Provide timely follow-up and feedback on problems in discipline laboratories to ensure that potential risks are effectively controlled.

  针对学科实验室存在问题进行及时跟踪和反馈，确保潜在风险得到有效控制。

3.5. Laboratory PI/Manager/Tutor 各实验室首席研究员/经理/教员：

- Determine that relevant personnel within the laboratory should be competent in laboratory safety.

  确定实验室内相关人员应具备实验室安全能力；

- Organize instruction and training and assessment of students in the laboratory on safe practices according to laboratory requirements.

  根据实验室要求，组织对实验室内学生的安全操作指导及培训考核；

- Responsible for the authorization of the use of equipment by laboratory personnel.

  负责实验室人员设备使用授权；

- Responsible for the good condition of facilities and equipment in the laboratory.

  负责实验室内设施设备的良好状态；

- Responsible for the handling and reporting of abnormalities of equipment in the laboratory.

负责实验室内设备异常情况的处理和汇报。

4. Processes and Requirements 流程及要求

4.1. General provisions 一般规定

- The use of 3D printers and 3D printer ancillary equipment must be strictly in accordance with the requirements of the operating instructions.

  使用 3D 打印机及 3D 打印机配套设备必须严格按照操作规程要求。

- Open flame is strictly prohibited, and electricity safety should be paid attention to.

  严禁明火，注意用电安全。

- 3D printing labs need to be kept ventilated and protected from light when in use, and after use, doors and windows must be closed and all equipment not in use turned off.

  3D 打印实验室在使用时，需要保持通风、避光，使用结束后，必须关好门窗，关闭所有不在使用中的设备。

- Ultra-fine particles (UFPs) and volatile organic compounds (VOCs) may be generated during printing. The above substances may cause harm to humans, so please keep the lid closed during printing and try to use printing materials with lower pollutant emission rates (e.g. PLA). If malodorous or odorous gases are generated during printing, please collect and treat them, and conduct environmental impact assessment if necessary.

  打印时可能产生超微颗粒（UFP）和挥发性有机化合物（VOCs），以上物质可能对人体造成伤害，打印过程中请保持机盖关闭，并尽量选择使用污染物排放率较低的打印材料（如 PLA）。如打印时产生恶臭或异味较大的气体，请收集处理，必要时进行环境影响评价。

- The lab must be cleaned up after 3D printing, and no material should be left on the equipment or floor.

3D 打印结束后，必须打扫实验室，设备及地面不得有材料残留。

- If there is a malfunction in use, you should immediately report it to the laboratory management, and dismantling the equipment by yourself is prohibited.

  如在使用之中出现故障，应立即向实验室管理人员报修，禁止私自拆卸设备。

- All equipment and consumables material are forbidden to be brought out of the lab without lab PI approval.

  所有设备、耗材，禁止未经实验室首席研究员许可带出实验场所。

- During the printing, the operator must wear the appropriate PPE, girls should tie bundles of long hair.

  在操作时，操作人员必须穿戴合适的个人防护用具，女生应扎束长发。

4.2. Potential Risks and Safety Measures 潜在风险及安全措施

- **FDM：Fused Deposition Molding Process 熔融沉积成型工艺**

1) Burns 烫伤

FDM 3D printer printheads operate at very high temperatures, up to 300 degrees Celsius. Touching the printhead without sufficient cooling is highly likely to cause burns. High temperature parts of the machine such as: printhead, hot bed.

It is recommended to wear heat-resistant gloves when operating to avoid burns.

FDM3D 打印机喷头的工作温度很高，热端温度可达 300℃。在未充分冷却的情况下触碰喷头极有可能导致烧伤。机器的高温部分如：喷头、热床。

建议操作时佩戴好隔热防护手套，避免不必要的烧伤。

2) Scratches 割伤

After the model is printed, it is necessary to use a scraper to scrape off the model on the heated bed, and it

is necessary to consider that the sharp edge of the scraper causes scratches when it is operated.

It is recommended to wear anti-cutting gloves when operating.

模型打印完后，需要使用刮刀把加热床上的模型刮下来，需考虑刮刀操作时，利刃导致刮伤。

建议操作时，佩戴防割手套。

3) Fire 火灾

If the temperature control detector fails, causing the heating nozzle to keep heating and melting the fire caused by short circuit.

如果温控检测失灵，导致加热喷头一直加热，融化短路引起的火灾。

4) Electric Shock 触电

The workbench itself is heated circuit board or heating silicone bonding, long-term use has the risk of aging leakage. In daily use, regularly check and maintain the machine, while ensuring that the machine has good grounding.

工作台本身就是加热电路板或者加热硅胶粘合而成，长期使用有老化漏电的风险。在日常使用中，

要定期检查维护机器，同时确保机器有良好接地。

5) Toxicity 毒害性

Most plastics will release some harmful gases under high temperature, and 3D printing is no exception. Especially when using engineering plastics such as ABS, toxic substances such as xylene may be released under high temperature. wearing a mask when operating, and keeping good ventilation are important, never print in a confined space.

大部分塑料在高温环境下都会释放出一些有害的气体，3D 打印也不例外。尤其是在使用 ABS 等

工程塑料时，在高温下可能会释放二甲苯等有毒物质。建议操作时，应戴好口罩，同时注意通风，

请勿在密闭空间打印。

- **SLA：Stereo lithography Apparatus** 光固化成形装置（又称光敏液相固化装置、立体光刻机）

  Stereoscopic Light-Curing Molding Process 立体光固化成型工艺

1) Toxicity 毒害性

The liquid photosensitive resin has certain toxicity and odor, whether it is the addition or replacement of materials, user should be careful to wear gloves and filter mask. The gas produced by the laser in the curing resin is harmful to people, and long-term inhalation has a great impact on human immune function. Therefore, a good exhaust system must be done to reduce the harmful toxic gases in the air. In addition, the resin also causes allergies in some people, so try not to touch the resin directly in use.

液态的光敏树脂具有一定的毒性和气味，无论是对材料的添加或者更换，都要注意戴好手套和防毒面具。同时激光在固化树脂中产生的气体对人也是有害的，长期吸入对人的免疫功能有很大影响。所以，必须做好排气系统，减少空气中的有害毒气。另外，树脂还会导致一些人过敏，所以在使用中尽量不要直接接触树脂。

2) Fire 火灾

Generally, the machine room is particularly dry and will likely cause a fire if exposed to an open flame.

一般机房特别干燥，如果遇明火，将有可能引发火灾。

3) Laser & UV 激光及紫外线

The ultraviolet laser beam from the Helium-Cadmium laser or the Argon-ion laser can easily burn the skin if it is accidentally irradiated. At the same time, ultraviolet light is also harmful to the human eye, in daily work are recommended to wear eyes protective gear.

氦 - 镉激光器或氩离子激光器发出的紫外激光束，如果不小心被照射到了，就很容易烫伤皮肤。同

时，紫外线光对人的眼睛也有害，在日常工作中都建议佩戴防护眼罩，或者设备设置防护垂帘。

- **SLM：Selective Laser Melt Molding Process 选择性激光熔融成型工艺**

1) Toxicity 毒害性

Workers operating 3D printers, or performing post-processing, are exposed to metal powders that have an average particle size of 25 to 150 microns and can easily enter the body and cause damage. For example, aluminum powder is commonly used as a powder for metal 3D printing. If workers are exposed to more aluminum than their body can excrete, the excess aluminum will be deposited in various tissues of the body, and the accumulation over time can lead to nerve damage. Therefore, it is recommended to use leather gloves with long cuffs and conductive safety shoes. Filter masks (FFP1, FFP2 and FFP3) protect workers from inhaling dust, fumes and aerosols.

操作 3D 打印机，或者进行后处理的工人，需要接触金属粉末，这些粉末平均粒径为 25 至 150 微米，能很容易地进入人体，造成损害。例如，铝粉常用作金属 3D 打印的粉末，如果工人接触到的铝量超过身体的排泄能力，多余的铝就会沉积在身体的各个组织中，长时间的积累会导致神经损伤。所以，建议使用长袖口的皮手套和导电安全鞋。过滤面罩（FFP1、FFP2 和 FFP3）可以保护工人免于吸入灰尘、烟雾和气溶胶。

In addition, metal 3D printing generally requires inert protective gases, such as argon or nitrogen, to prevent powder oxidation during processing. Leakage of these inert gases can be a risk of asphyxiation. It is recommended to install oxygen sensors in the rooms where these machines are placed to continuously record the oxygen level in the room.

此外，金属 3D 打印一般都需要惰性保护气体，比如氩气或氮气，防止加工过程中粉末氧化。这些惰性气体泄漏可能会有窒息的危险。建议在放置这些机器的房间安装氧含量气体探测器，以持续

记录房间内的氧气含量。

2) Fire 火灾

If there is a static arc and the surrounding environment is very dry, when dealing with reactive metals, it is easy to cause a fire may inside the machine. It is recommended to have D type fire-extinguisher suitable for electrical fires.

如果存在静态电弧，又刚好处理的是活性金属，如果周边环境是很干燥的，那就可能在机器内部发生火灾。建议配备适用于电气火灾的 D 型灭火器。

3) Dust Explosion 粉尘爆炸

During the operation, there will be some titanium, aluminum, magnesium and other metal powders suspended in the air, and after reaching a certain concentration, if they encounter an ignition source, they will also burn or even produce an explosion. In addition, hot surfaces, hot gases are likely to produce sparks and stray currents, thus becoming a source of ignition.

在操作过程中，会有一些钛、铝、镁等金属粉末悬浮在空气中，达到一定浓度后，如果遇到火源，也会发生燃烧甚至产生爆炸。另外，热的表面、热气体都有可能产生火花和杂散的电流，从而成为点火源。

The conditions that cause an explosion include: dust, oxygen, fuel, enclosed. Therefore, the storage, processing and post-processing of metal powders should avoid sources of ignition and static electricity.

引起爆炸的条件包括：粉尘、氧气、燃料、封闭。因此金属粉末的存储、加工、后处理，都要避免火源和静电。

4) Pollution 污染

Some machines produce harmful gases during the printing process, which need to be treated in a non-

hazardous way, such as using activated carbon for adsorption, to prevent to pollute the environment. At the same time, the handling and collection of metal powder "scattered" in different parts of the equipment, in this process there are also fire, explosion and inhalation injuries and other risks.

有些机器在打印过程会产生一些有害气体，需要进行无害化处理，例如使用活性炭进行吸附等，防止污染环境。同时，处理和收集设备中不同部位“散落”的金属粉末，在这个处理过程中也存在上述火灾、爆炸和吸入性伤害等风险。

5. Attachment 附件

None 无