Standard Operating Procedure

TU/e

SOP details

Title	Oxygen plasma treatment
Description	This SOP describes how to perform oxygen plasma treatment to the Si molds, Ormomolds and polymer substrates with the TopoChip imprints
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SOP number	1.2
Version number	2

	Name	Date	Signature
Prepared	Phani Krishna Sudarsanam	27-05-2020	
Revised	Mehmet Tas	28-02-2021	
Reviewed	Jan de Boer	23-3-21; 16-4-21	
Authorized			

Version changes

Version	Name	Date	Changes made
1	Phani Krishna Sudarsanam	27-05-2020	Made in TU/e
2	Mehmet Tas	28-02-2021	Revised, more details and figures added
3	Jan de Boer	23-03-2021	Reviewed and comments given using track changes
4	Mehmet Tas	01-04-2021	Comments addressed
5	Jan de Boer	16-4-2021	Reviewed
6	Burcu Gumuscu	20-5-2021	Reviewed, finalized.

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1 Purpose

This SOP describes how to treat the Silicon (Si) master mould and Ormomould and the TopoChip imprints with oxygen plasma treatment.

2 Principle

Oxygen plasma treatment is used for many purposes. The main application which we are interested in, is that it removes any foreign objects that are present in between the features of the TopoChip on the moulds. This process is done before the silane treatment of the moulds. In this process, oxygen is used as a precursor gas that is bled into a vacuum chamber with the mould. Then a radio frequency plasma is generated inside the chamber. The radio waves coupled with the pressure in the vacuum chamber results in the ionization of oxygen molecules which, in turn, form plasma. It has also been seen that the cell adhesion to the surfaces is improved on the imprints which were oxygen plasma treated compared to untreated imprints. Therefore, TopoChip imprints are also oxygen plasma treated.

3 Before You Start

The Si/Ormo mould with the TopoChip imprints are cleaned first with pressurized nitrogen to remove any dust particles and then further proceeded with performing the oxygen plasma treatment. This SOP can be used for both treatment of Si mould, Ormomould and the polymeric TopoChips. There is a standard protocol with setting used in the Feynman lab for the TopoChip fabrication and specifically optimized for surface activation. Before using this SOP, get introduction to the microfabrication lab for the cleanroom (Feynman lab) and the equipment needed for this process from the super users.

4 Required materials

4.1 Workplace

This SOP can be performed in the microfabrication lab (Gemini- Noord, Feynman lab). Follow the safety protocols instructed by the lab managers and perform the experiment accordingly in allocated locations in the lab.

4.2 Equipment and disposables

- Plasma asher (Emitech K1050X)
- N_2 (Nitrogen) spray gun

5 Procedure

5.1 Working procedure

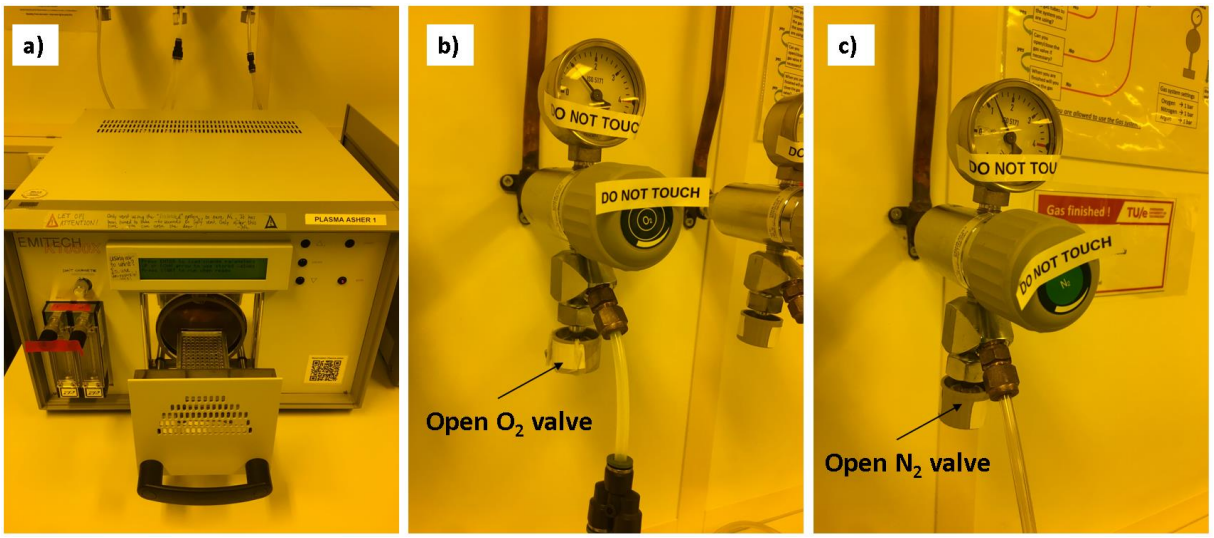
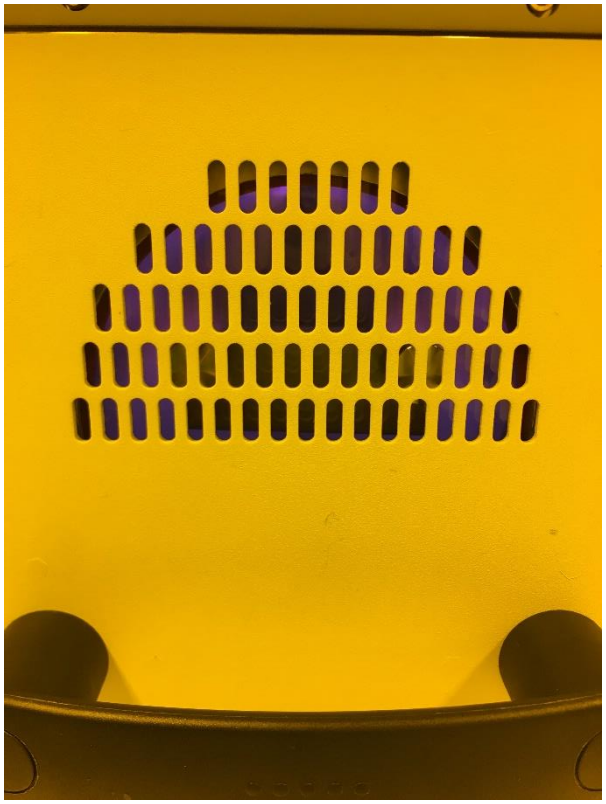


Figure 1. Plasma asher setup. (a) Plasma asher chamber, (b) O_2 valve, (c) N_2 valve

1. The moulds/imprints intended to be used in the plasma asher are cleaned first using the N_2 spray gun.
2. Switch on the plasma asher using the switch placed at the back and make sure the N_2, O_2 gas tubes are connected to the plasma asher at the back. N_2 line is shared with the sputter coating therefore make sure that the line is connected to the push connector at the back of the plasma asher.
3. Open the chamber slide door (see Figure 1a).
4. Turn on the valves of the oxygen and nitrogen supply before using the equipment (see Figure 1 b and c).
5. The parameters used for the plasma treatment of TopoChip moulds/imprints are
    - RF power: 50 watts
    - Ashing time: 30 seconds
    - Bleed delay time: 2
    - Processed gas: Gas 2 (O_2)
    - Gas Flow Rate: 10 sccm
    - Vent valve: Unrestricted
    - Restricted vent time: 60 sec
    - Pump spin down time: 10 sec
    - Vent /hold time: 0 sec
    - Gas shutoff time: 1 sec
    - Turbo pumping enabled: 0
6. These parameters are programmed into the system consecutively and the chamber is run without any samples for the first time.

7. Make sure that the plasma is generated in the chamber during the first run by observing the chamber to confirm that it fills with a pale purple color as seen below.



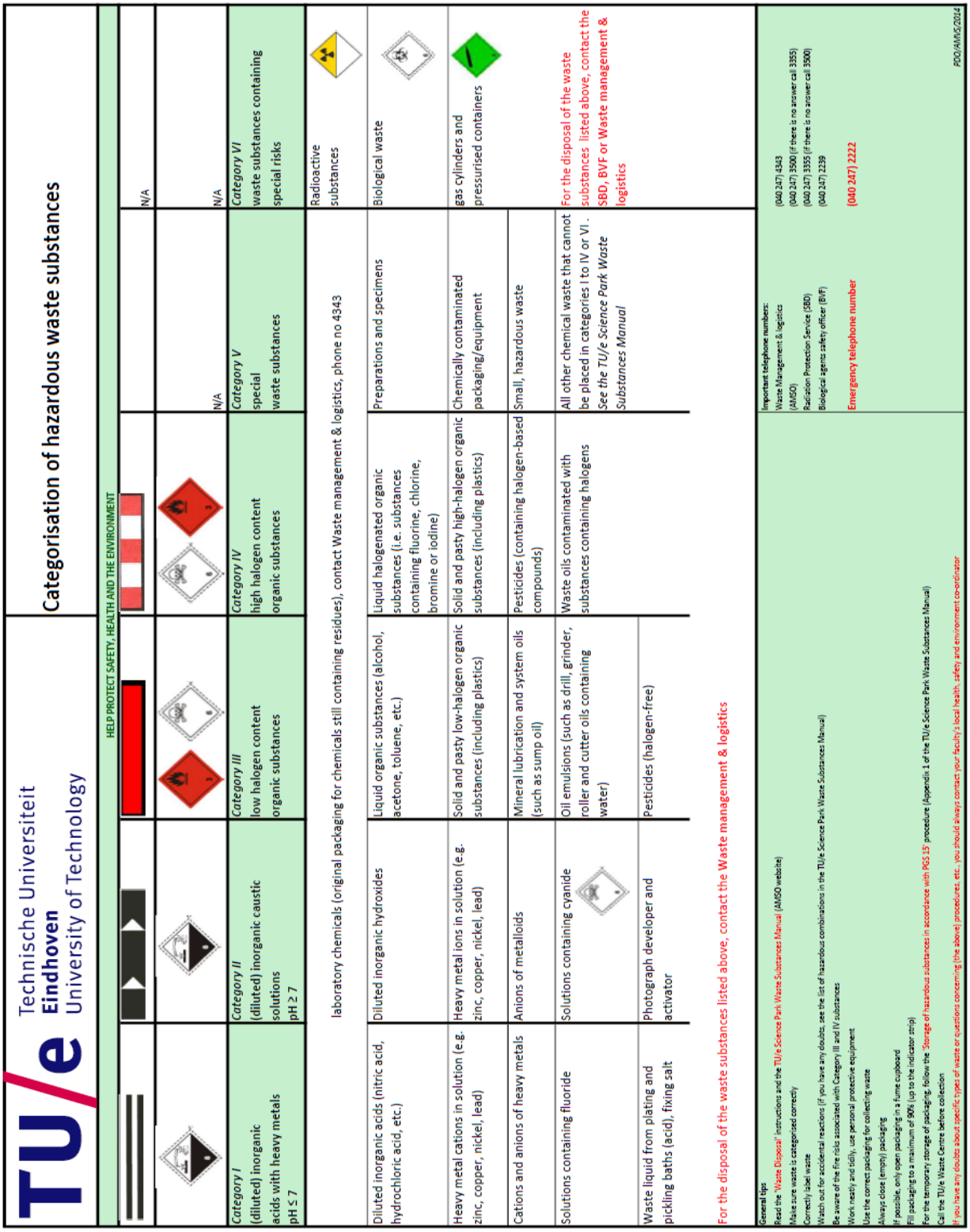
8. After the first run, the TopoChip moulds with surface to be treated are kept in the chamber facing upwards and protocol is run again. First run is performed to make sure that the plasma strikes with desired parameters, it will also remove any contaminations inside the chamber. Take the moulds/imprints out of the chamber and label them on the petri dishes in which they are stored accordingly.

5.2 Safety

Work in the Feynman lab in Gemini-Noord according the safety regulations. Follow the instructions given in the lab introduction by the lab managers.

6 Waste

When working in the Feynman lab, handle waste according to guidelines which are labelled at the waste disposal based on its categories as given below in the table 1



Technische Universiteit Eindhoven University of Technology

Categorisation of hazardous waste substances

HELP PROTECT SAFETY, HEALTH AND THE ENVIRONMENT

					N/A	
				N/A	N/A	
Category I (diluted) inorganic acids with heavy metals pH ≤ 7	*Category II* (diluted) inorganic caustic solutions pH ≥ 7	*Category III* low halogen content organic substances	*Category IV* high halogen content organic substances	*Category V* special waste substances	*Category VI* waste substances containing special risks	
laboratory chemicals (original packaging for chemicals still containing residues), contact Waste management & logistics, phone no 4343					Radioactive substances	
Diluted inorganic acids (nitric acid, hydrochloric acid, etc.)	Diluted inorganic hydroxides	Liquid organic substances (alcohol, acetone, toluene, etc.)	Liquid halogenated organic substances (i.e. substances containing fluorine, chlorine, bromine or iodine)	Preparations and specimens	Biological waste	
Heavy metal cations in solution (e.g. zinc, copper, nickel, lead)	Heavy metal ions in solution (e.g. zinc, copper, nickel, lead)	Solid and pasty low-halogen organic substances (including plastics)	Solid and pasty high-halogen organic substances (including plastics)	Chemically contaminated packaging/equipment	gas cylinders and pressurised containers	
Cations and anions of heavy metals	Anions of metalloids	Mineral lubrication and system oils (such as sump oil)	Pesticides (containing halogen-based compounds)	Small, hazardous waste		
Solutions containing fluoride	Solutions containing cyanide	Oil emulsions (such as drill, grinder, roller and cutter oils containing water)	Waste oils contaminated with substances containing halogens	All other chemical waste that cannot be placed in categories I to IV or VI . *See the TU/e Science Park Waste Substances Manual*	For the disposal of the waste substances listed above, contact the SBD, BVF or Waste management & logistics	
Waste liquid from plating and pickling baths (acid), fixing salt	Photograph developer and activator	Pesticides (halogen-free)				

For the disposal of the waste substances listed above, contact the Waste management & logistics

General tips
Read the 'Waste Disposal' instructions and the TU/e Science Park Waste Substances Manual (AMSO website)
Make sure waste is categorised correctly
Correctly label waste
Watch out for accidental reactions (if you have any doubts, see the list of hazardous combinations in the TU/e Science Park Waste Substances Manual)
Be aware of the fire risks associated with Category III and IV substances
Work neatly and tidily, use personal protective equipment
Use the correct packaging for collecting waste
Always close (empty) packaging
If possible, only open packaging in a fume cupboard
Fill packaging to a maximum of 90% (up to the indicator strip)
For the temporary storage of packaging, follow the 'Storage of hazardous substances in accordance with PGS 15' procedure (Appendix 1 of the TU/e Science Park Waste Substances Manual)
Call the TU/e Waste Centre before collection
If you have any doubts about specific types of waste or questions concerning (the above) procedures, etc., you should always contact your faculty's local health, safety and environment co-ordinator

Important telephone numbers:
Waste Management & logistics (AMSO) (040 247) 4343
Radiation Protection Service (SBD) (040 247) 3500 (if there is no answer call 3355)
Biological agents safety officer (BVF) (040 247) 3355 (if there is no answer call 3500)
(040 247) 2239

Emergency telephone number (040 247) 2222

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Table 1: Categories of hazardous liquid waste