TiO_2 PHOTOCATALYSIS FOR WATER PURIFICATION

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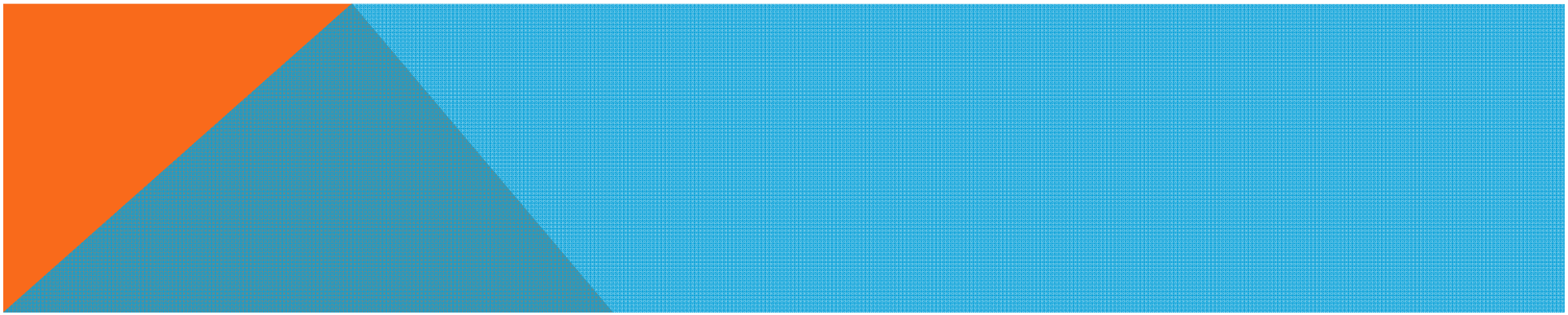
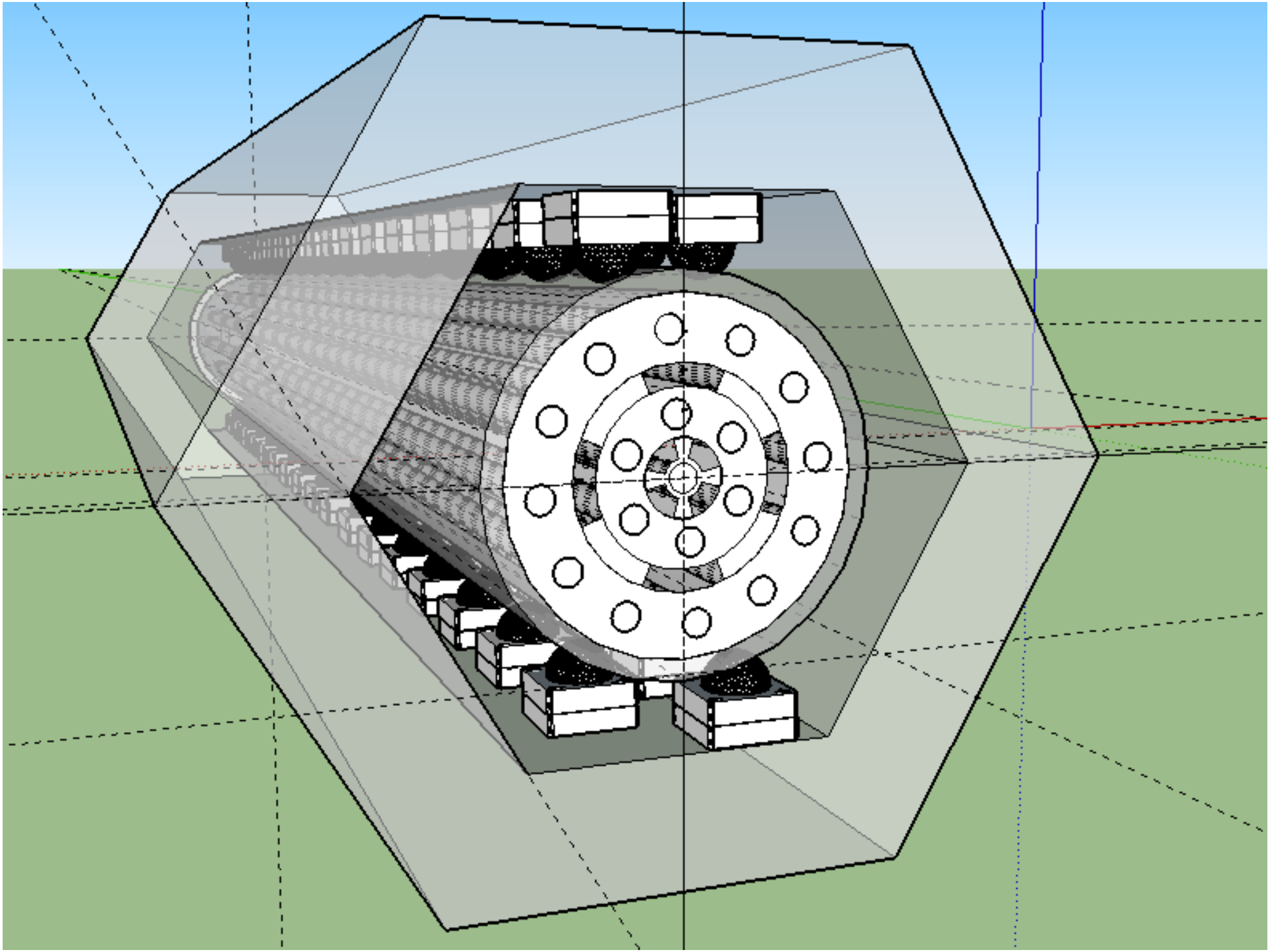
PURPOSE

- Build a system that purifies water using light
- Save water!



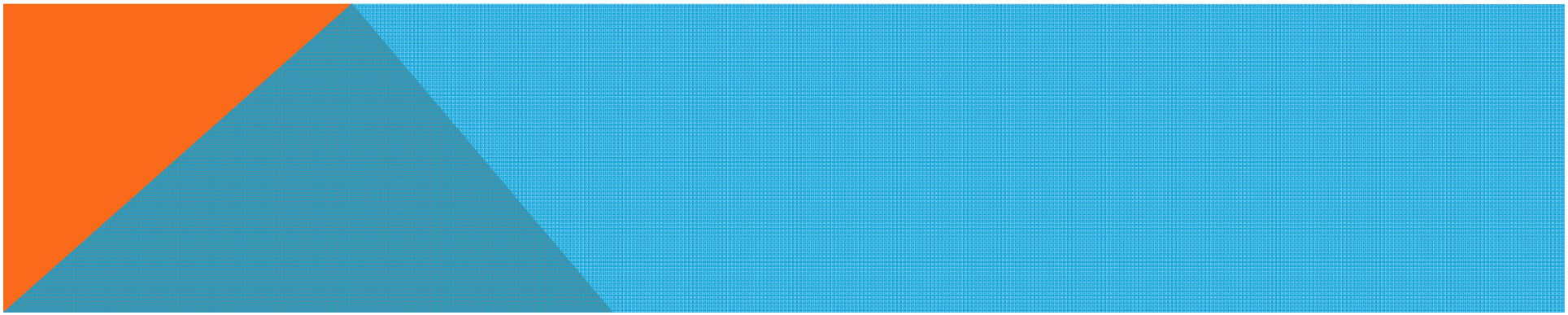
DEFINITIONS

- Photocatalysis – A reaction caused by the interaction between light and the catalyst.
- Purification – Breaking down all organic contaminants into simple molecules.
- Titanium Dioxide – Our catalyst.



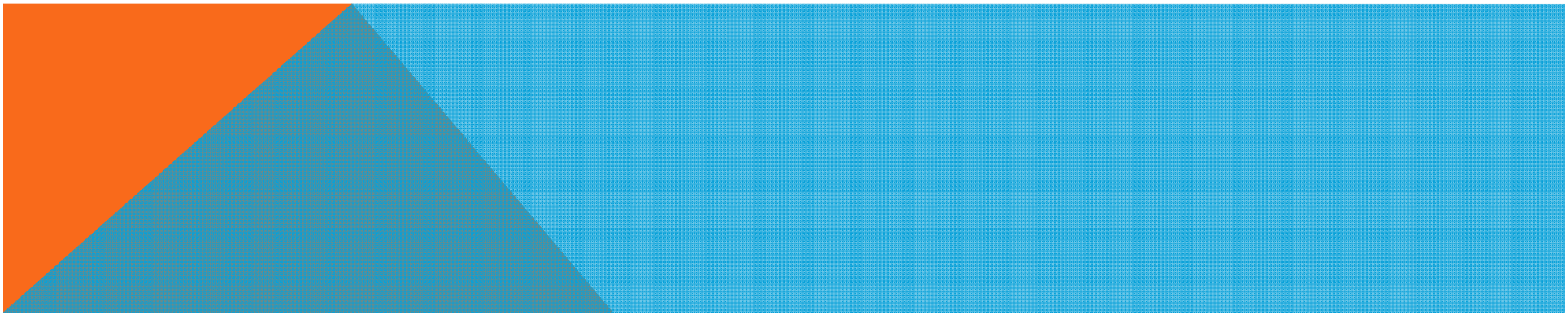
THE PROCESS

- Light shines onto TiO_2
- A photon from the light excites an electron from the TiO_2 and leaves an electron hole.



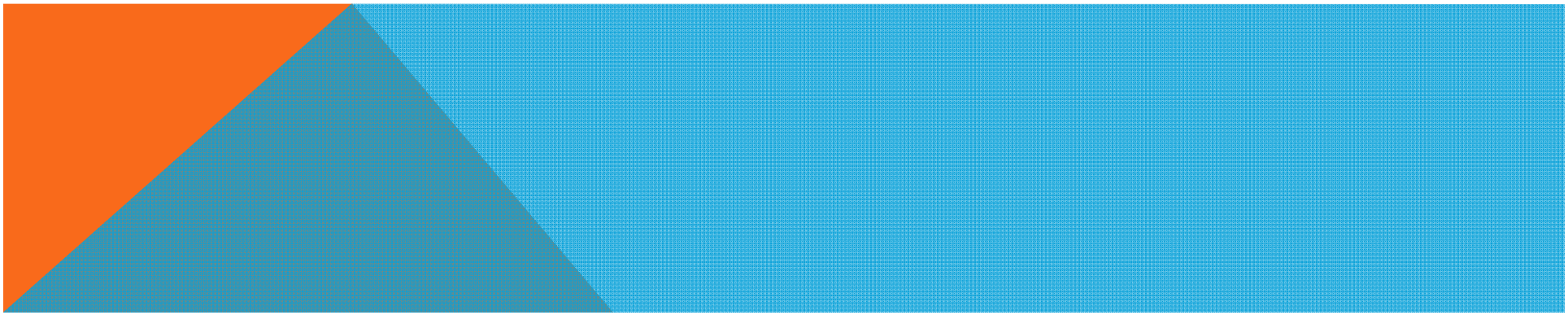
ELECTRON HOLES

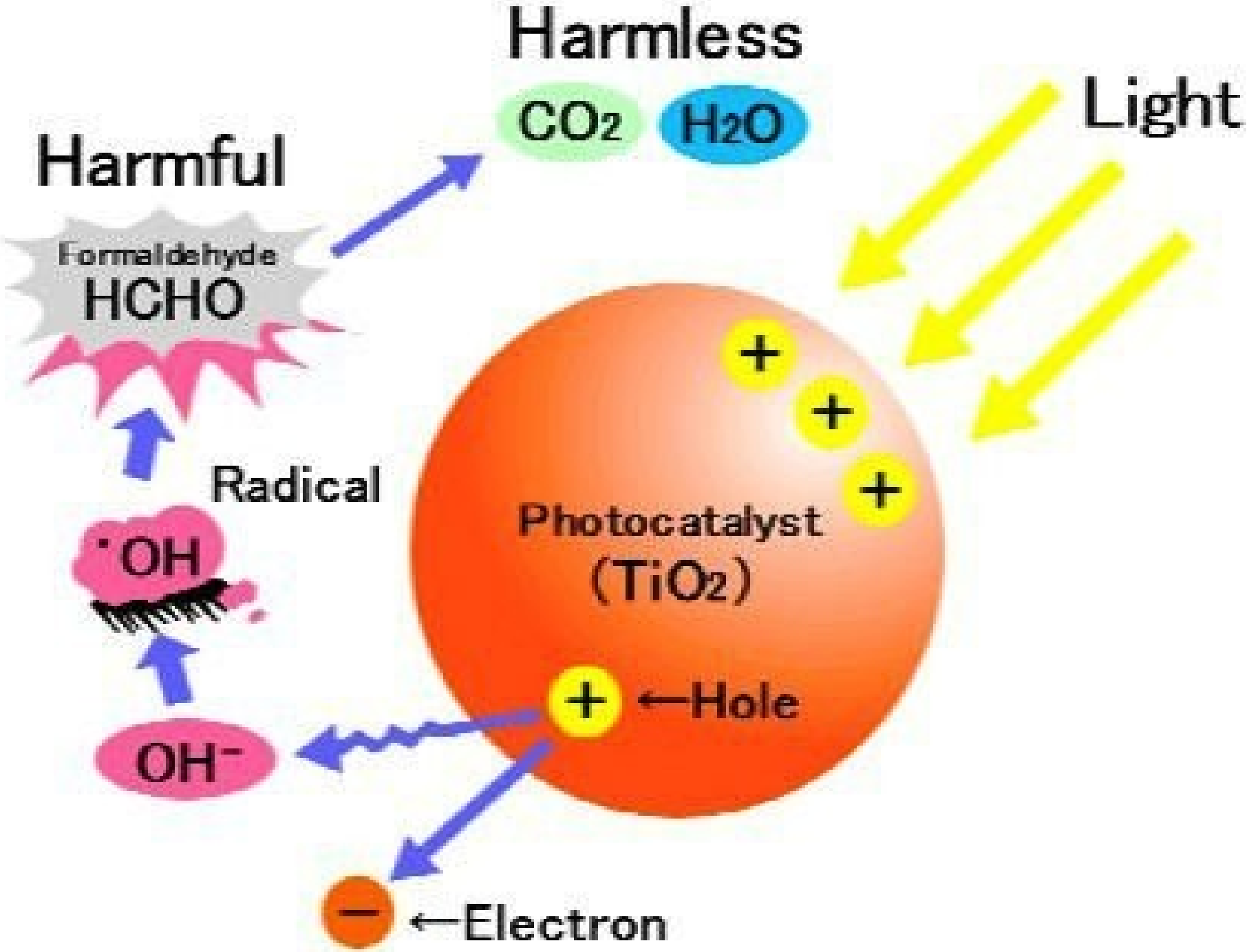
- Electron hole – a space that an electron leaves behind when it is taken away from a valence band.
- Acts as a particle because of the way other particles react with it.
- Has a positive charge.



THE PROCESS CONTINUED

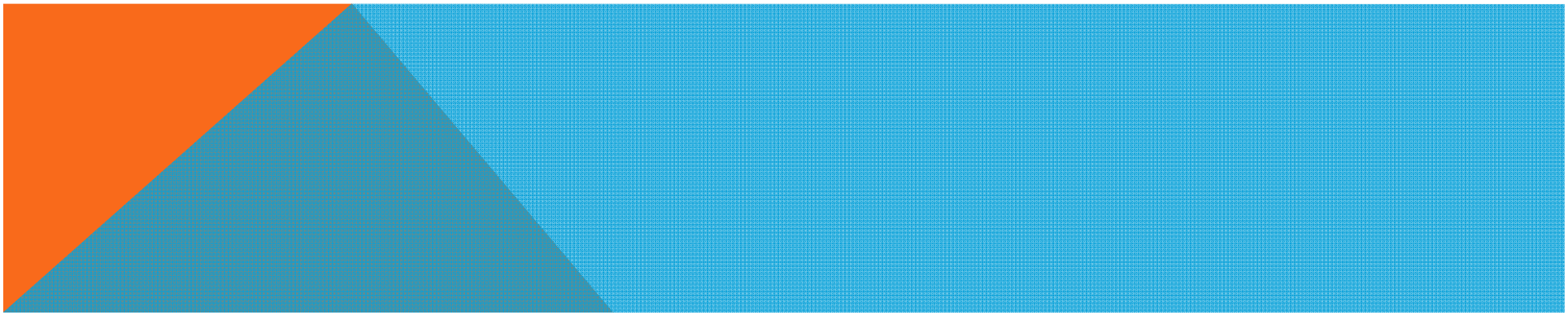
- The electrons and electron holes react with the water and create two things:
  - Hydroxyl radicals - OH
  - Superoxide anions – O_2^-
- Hydroxyl radicals and superoxide anions react with contaminants.
- Break down contaminants.




Harmless
CO_2
H_2O
Light
Harmful
Formaldehyde
HCHO
Radical
·OH
OH^-
Photocatalyst
(TiO_2)
+
+
+
+ ←Hole
− ←Electron

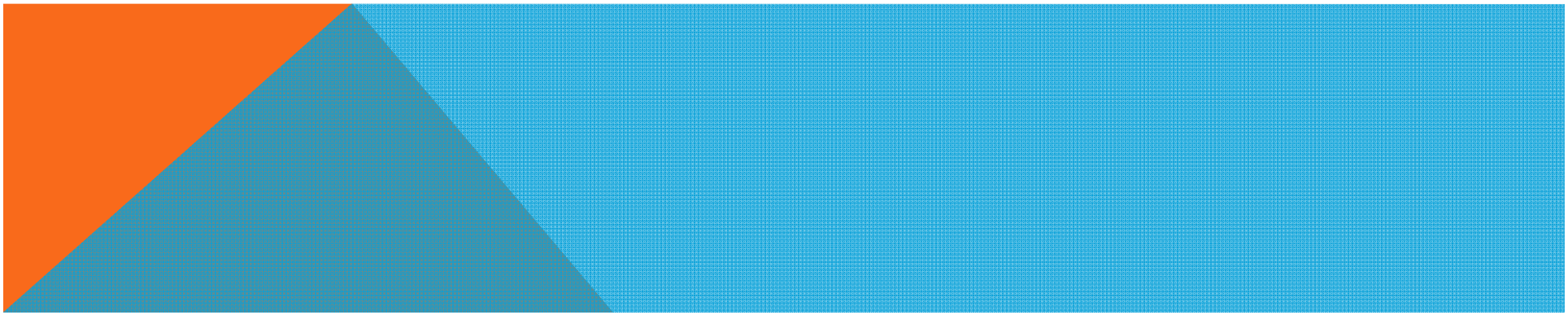
COATING

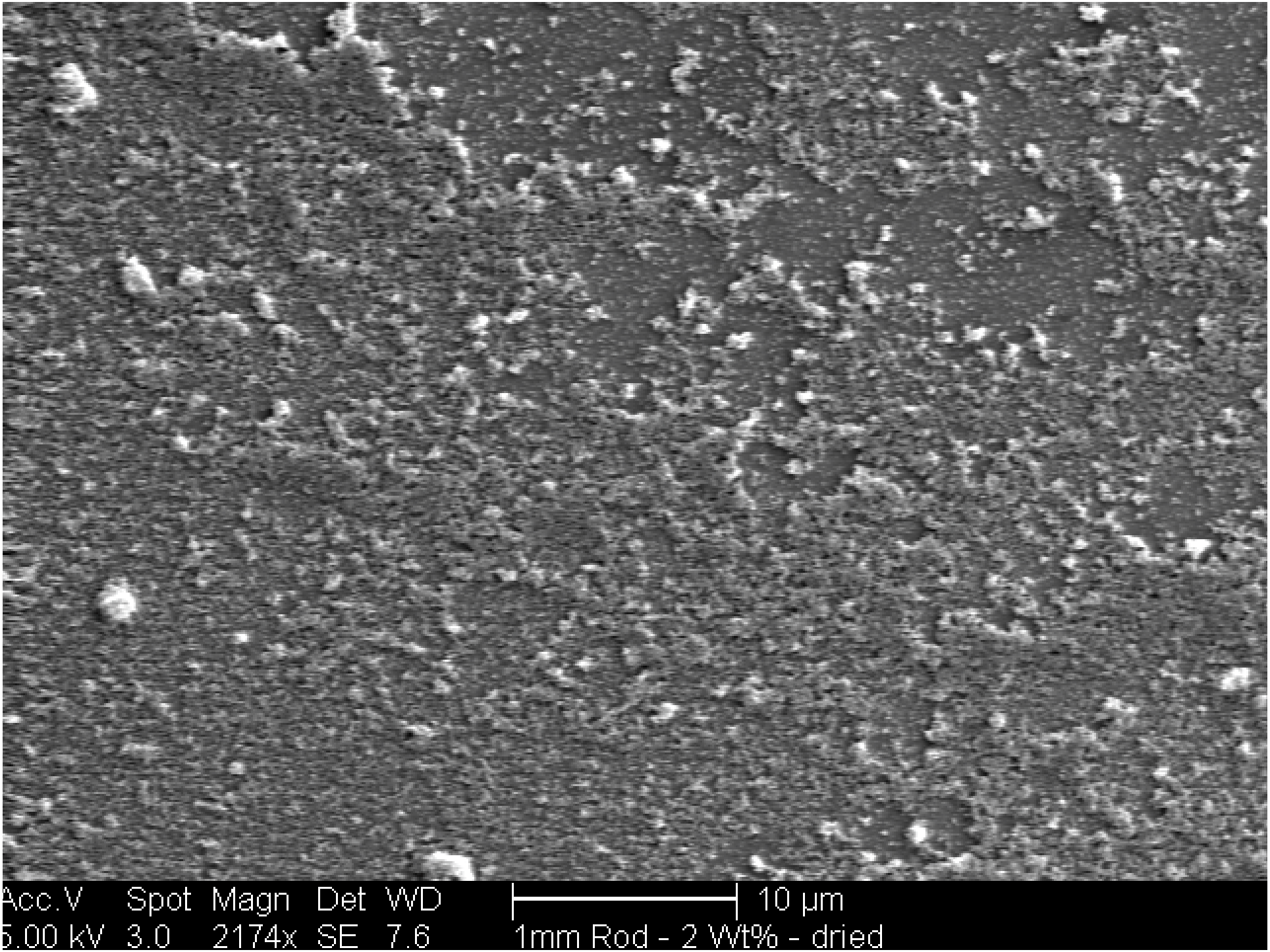
- Coated quartz rods in TiO_2 mixture.
- TiO_2 mixture had different weight percentages of TiO_2
- Question: What weight percentage of TiO_2 works best to coat the quartz rods?
- Tested: 2%, 4%, 6%, and 8% of TiO_2

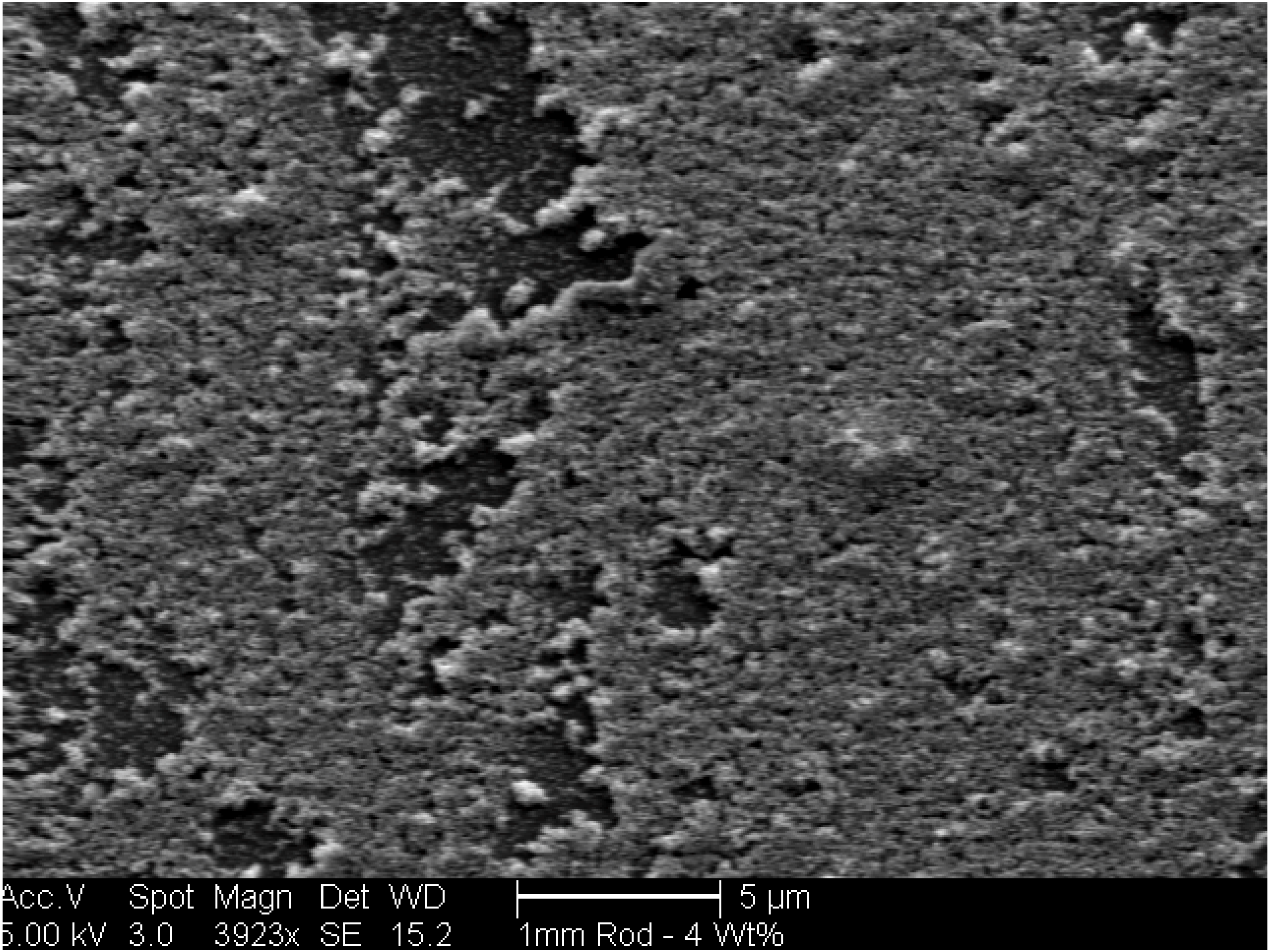


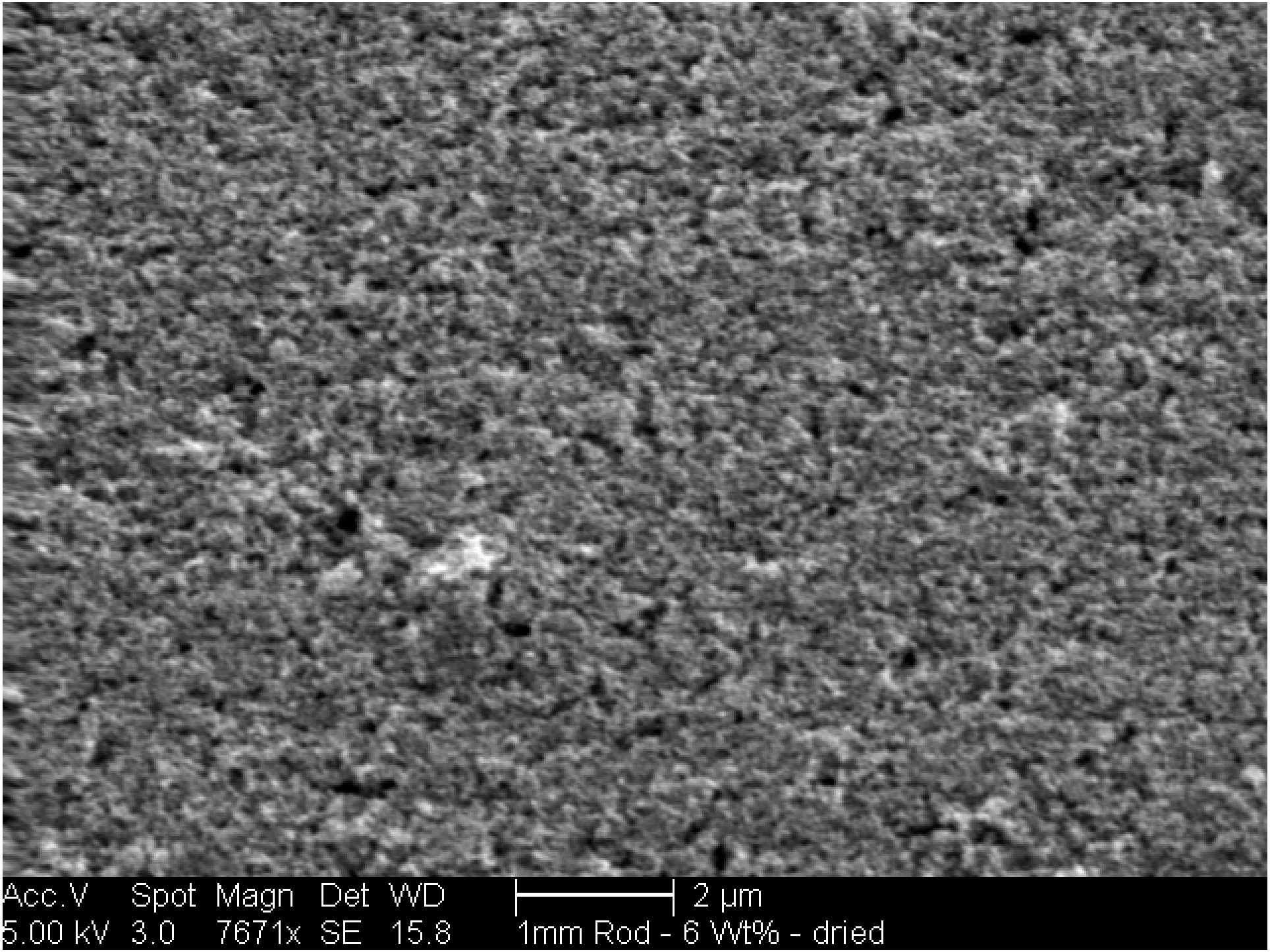
PROCEDURE

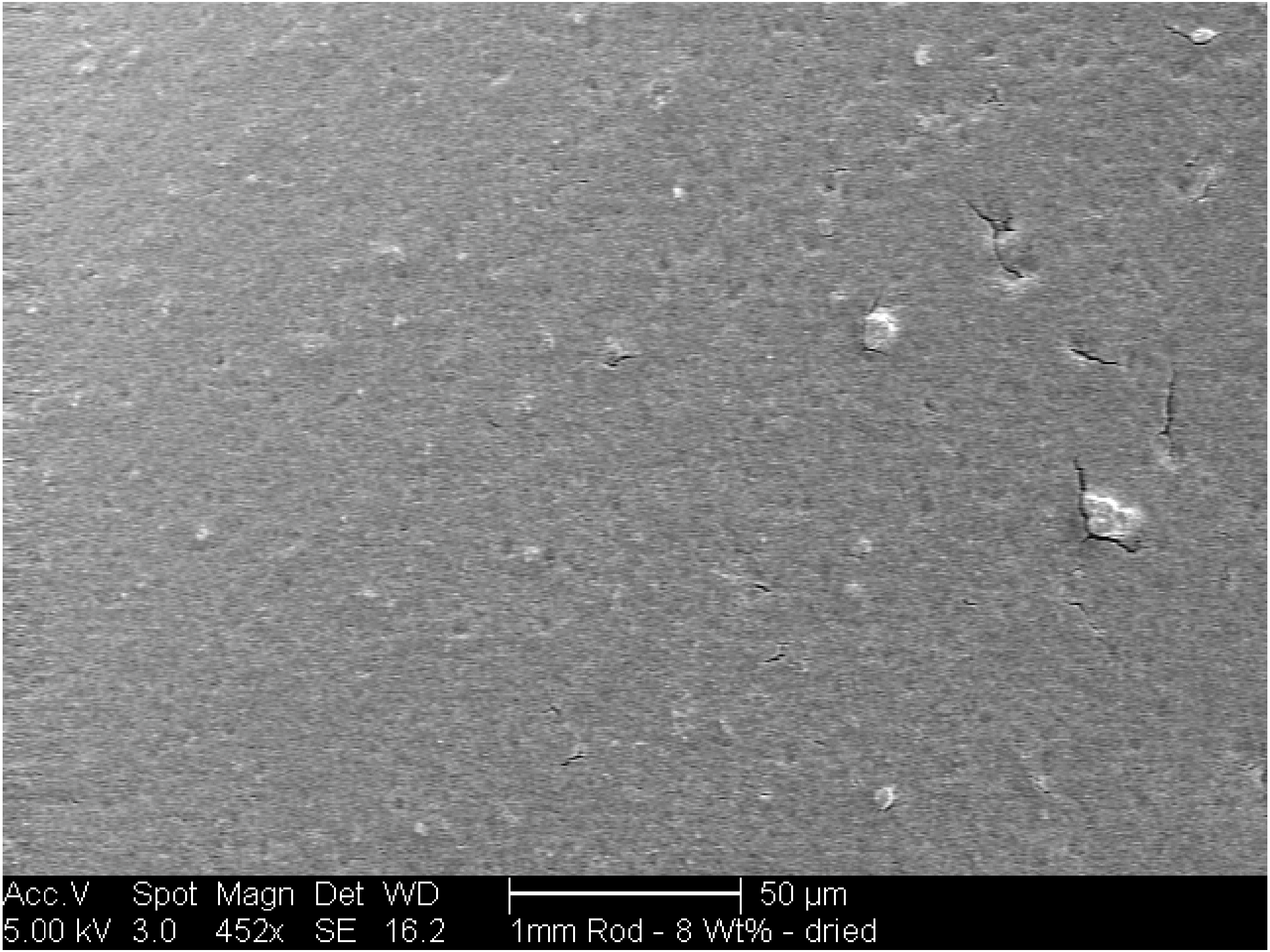
- Broke 1 mm rod into pieces each 35 mm long
- Coated in TiO_2 mixtures
- Baked in oven for 4 hours at 500 degrees C.
- Took out and looked at under the SEM




Acc.V Spot Magn Det WD
5.00 kV 3.0 2174x SE 7.6
10 µm
1mm Rod - 2 Wt% - dried


Acc.V Spot Magn Det WD
5 µm
5.00 kV 3.0 3923x SE 15.2
1mm Rod - 4 Wt%


Acc.V Spot Magn Det WD
5.00 kV 3.0 7671x SE 15.8
2 µm
1mm Rod - 6 Wt% - dried

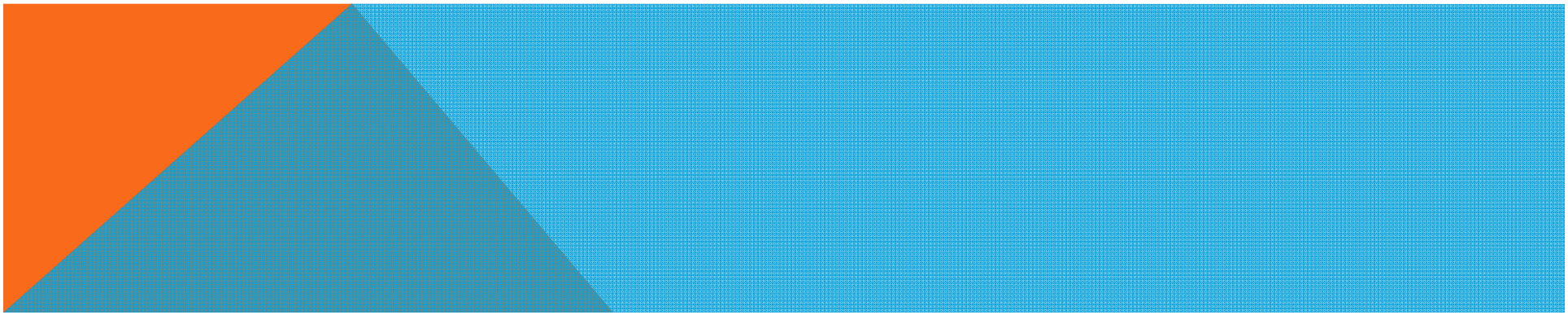

Acc.V Spot Magn Det WD
5.00 kV 3.0 452x SE 16.2
50 µm
1mm Rod - 8 Wt% - dried

FINDINGS

- 2% and 4%: Spotty coating
- 6%: Mostly smooth and uniform
- 8%: Showed signs of cracking from baking

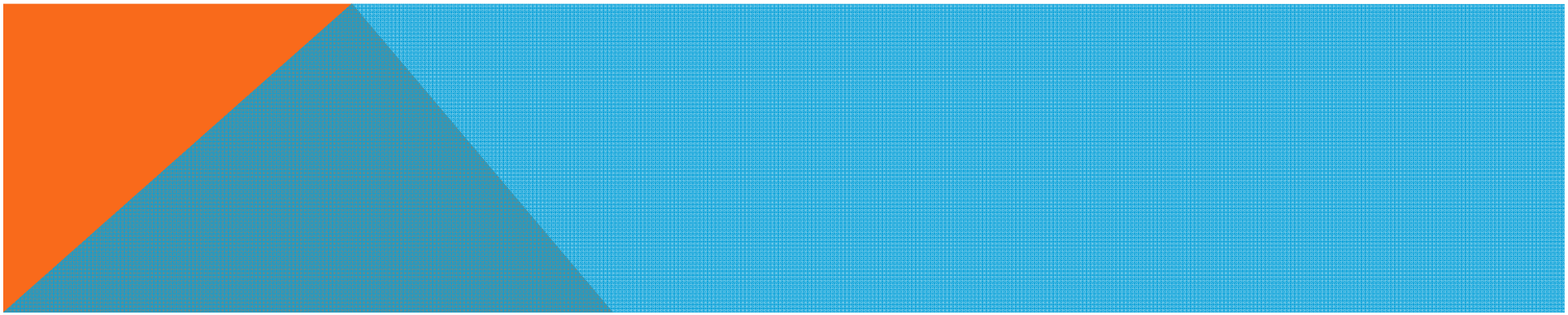
CONCLUSIONS

- 6% is the best option
- 4% could work
- 8% also could work if we use different drying procedure instead of baking



GOALS FOR THE REST OF THE SUMMER

- Use a dip coater to coat the rods
- Assemble a full reactor



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