

# Plasma Processing of fullerene C<sub>60</sub> for industrial applications

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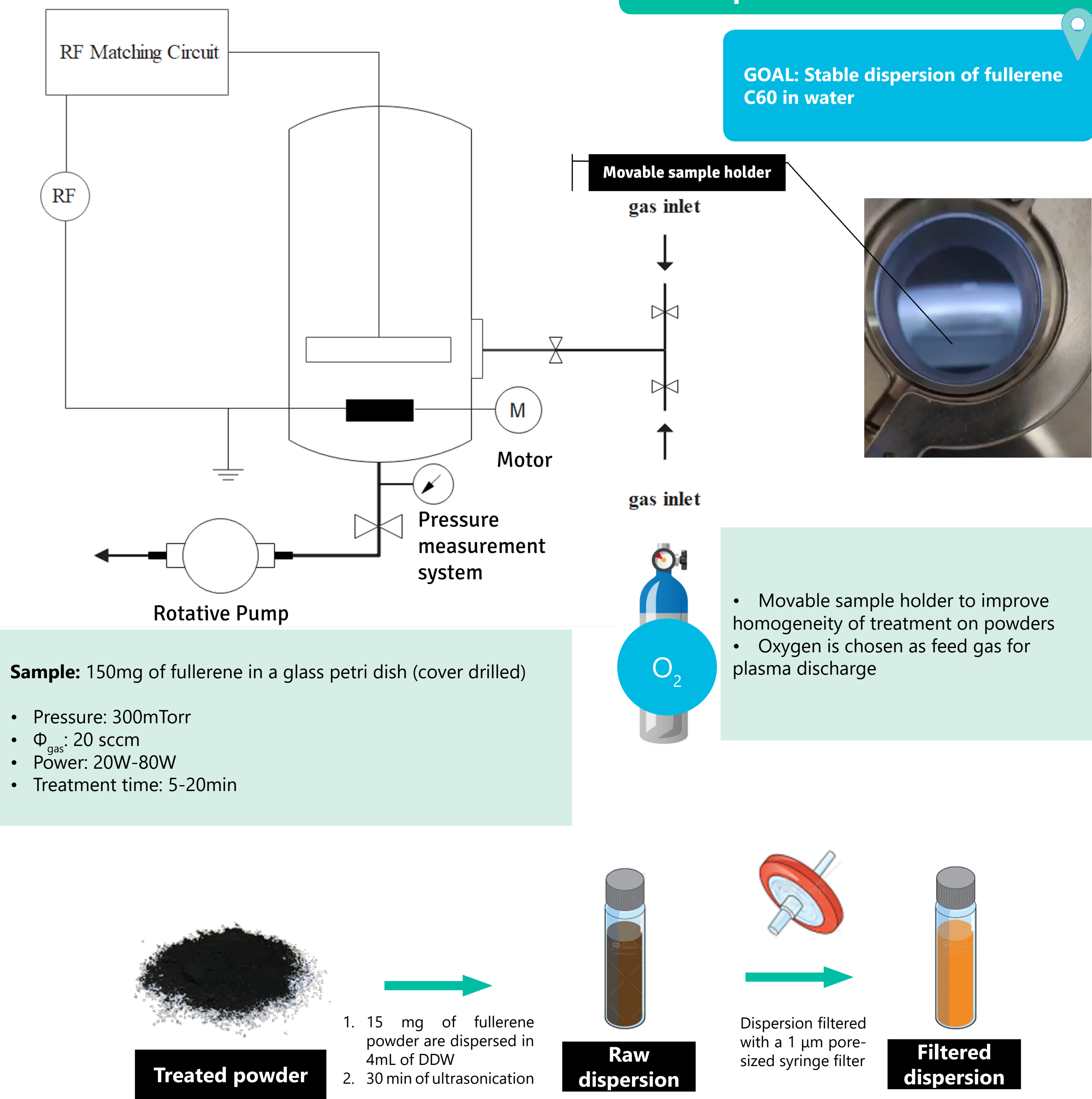
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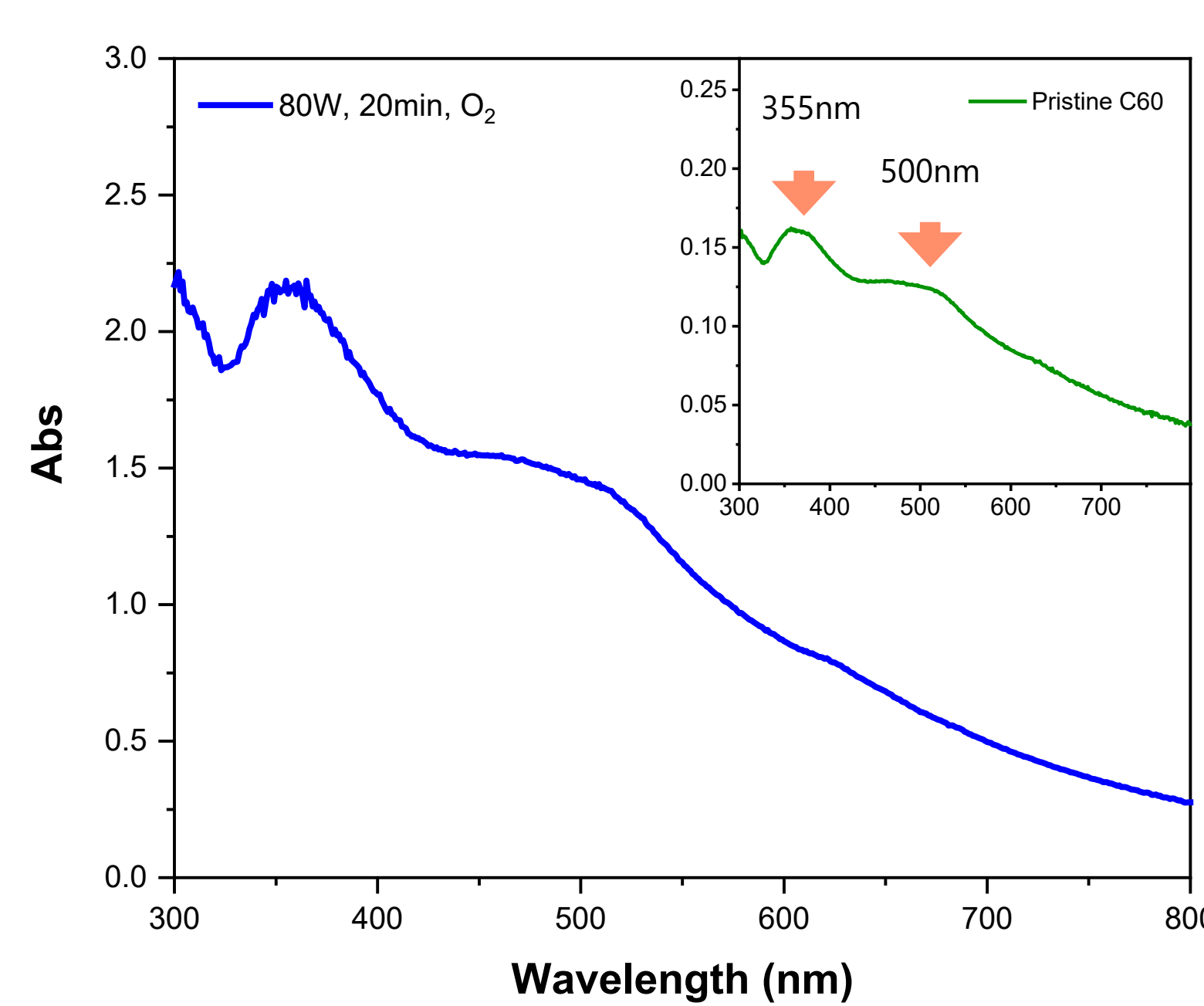
## O<sub>2</sub> LOW PRESSURE PLASMA TREATED C<sub>60</sub> FOR WATER DISPERSION ENHANCEMENT - in

collaboration with G. Palazzo and H. Mateos Cuadrado

### Experimental Section

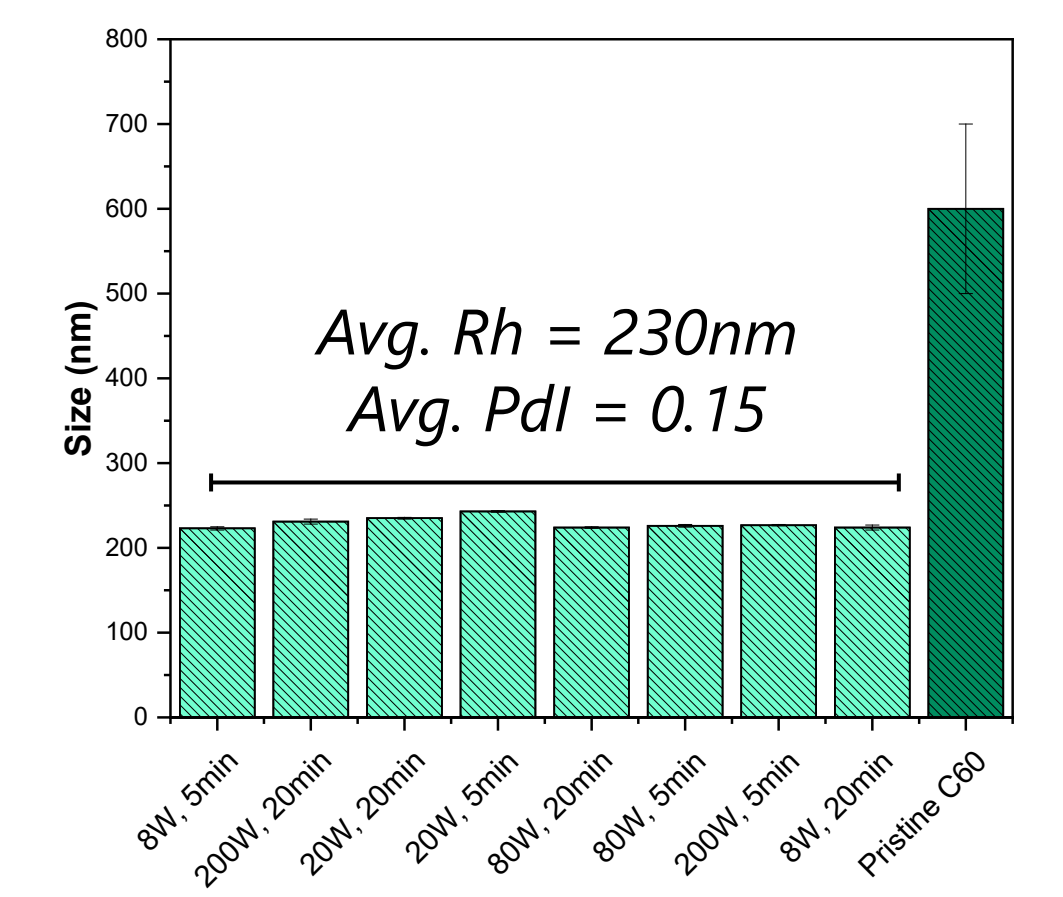


### Results

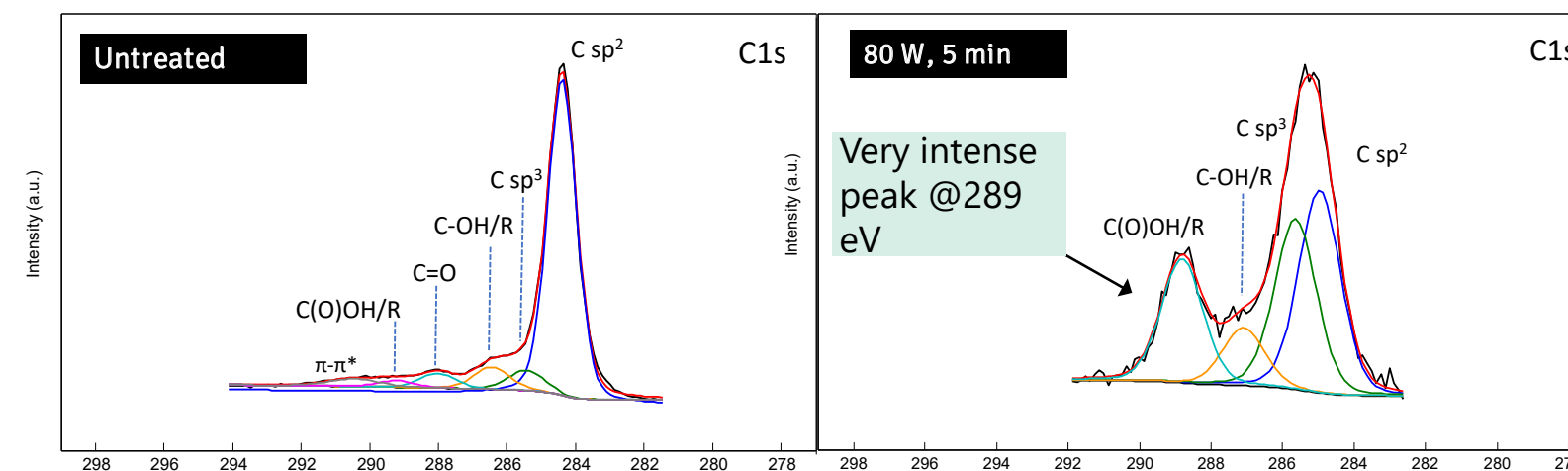


#### UV-Vis spectroscopy on filtered dispersion

- Main band of absorption: 355nm
- Wide band at 500nm: C<sub>60</sub> - water complexes
- Significant increase in Abs in comparison to control sample
- No net trend with treatment time and power



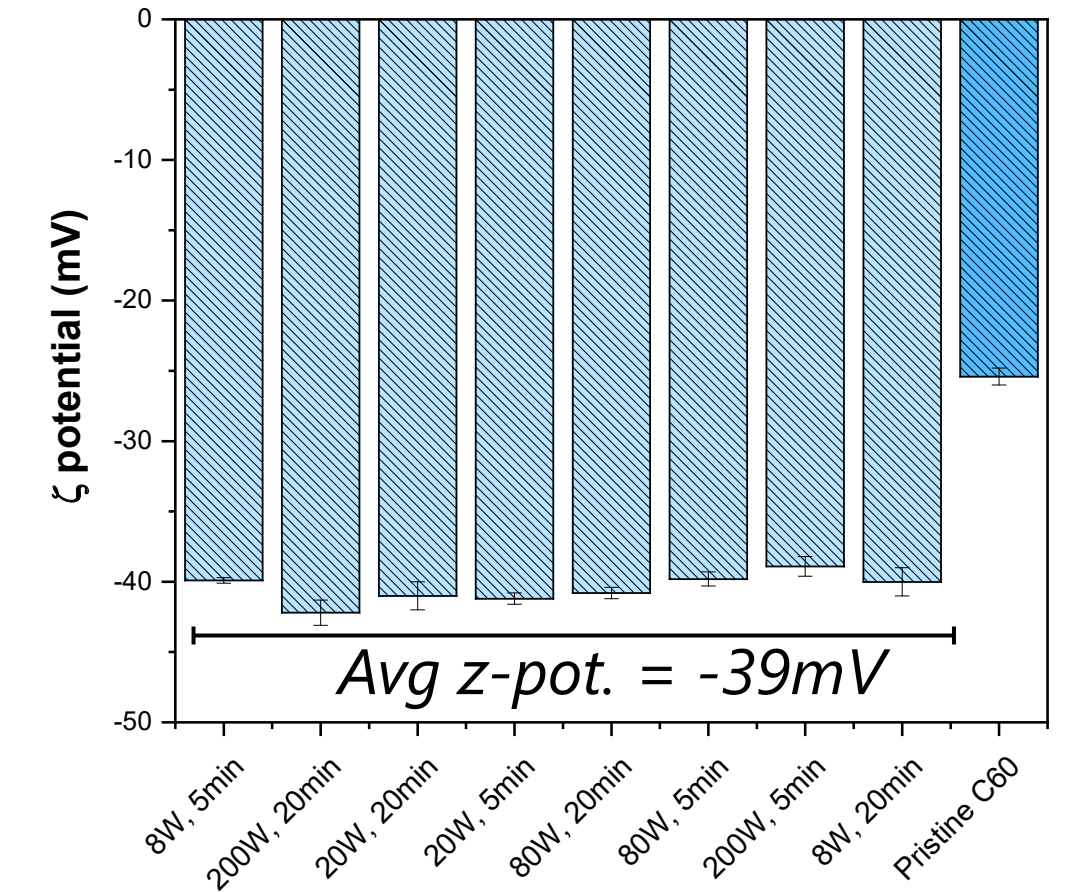
#### XPS on filtered dispersions (drop-casted)



#### XPS on powder

| Sample                    | % at. C | % at. O |
|---------------------------|---------|---------|
| Untreated C <sub>60</sub> | 98.0    | 2.0     |
| 20W, 20'                  | 83.4    | 16.6    |
| 20W, 5'                   | 81.4    | 18.6    |
| 80W, 20'                  | 81.2    | 18.8    |
| 80W, 5'                   | 82.7    | 17.3    |

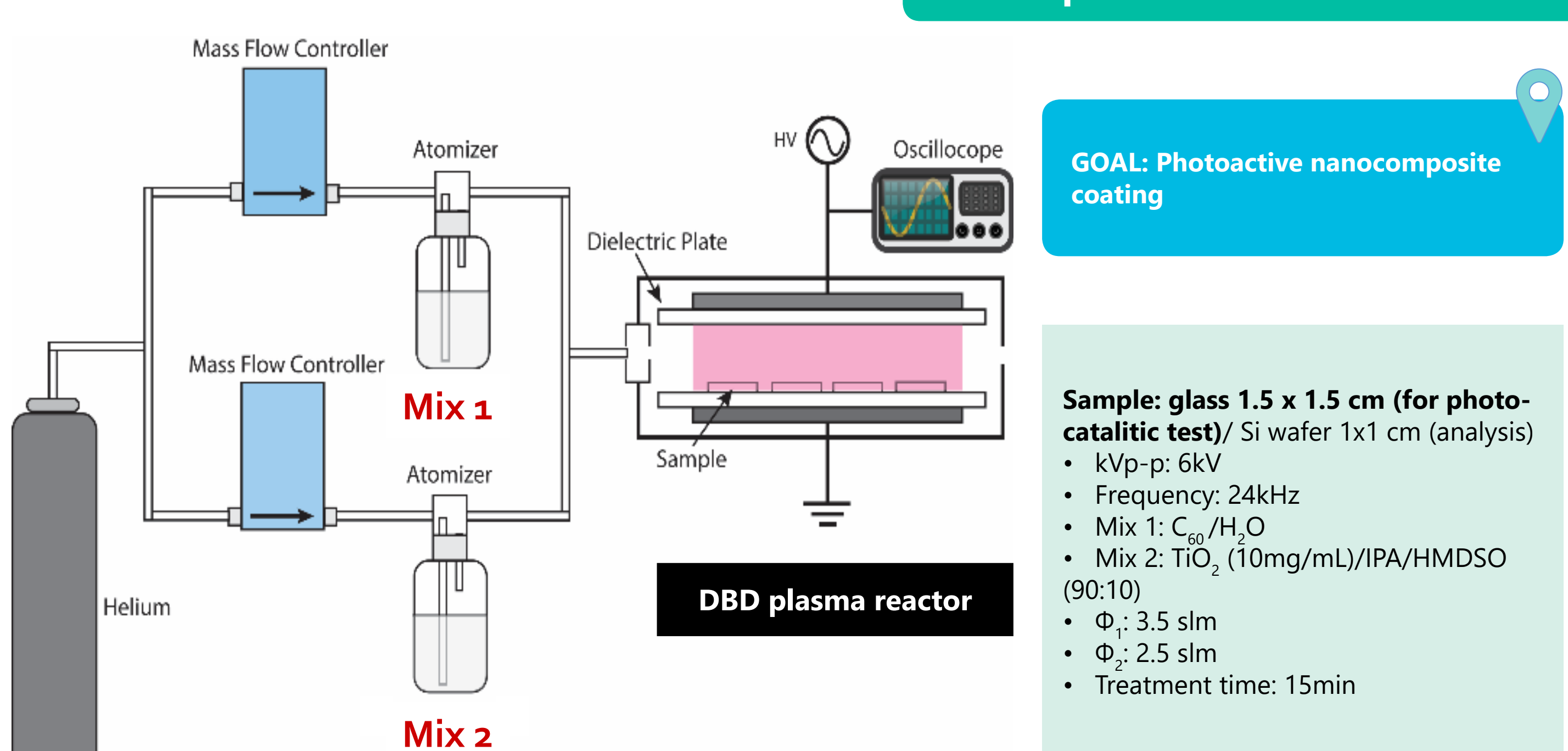
- Oxygen at. % increases with plasma treatment
- O-containing moieties grafted



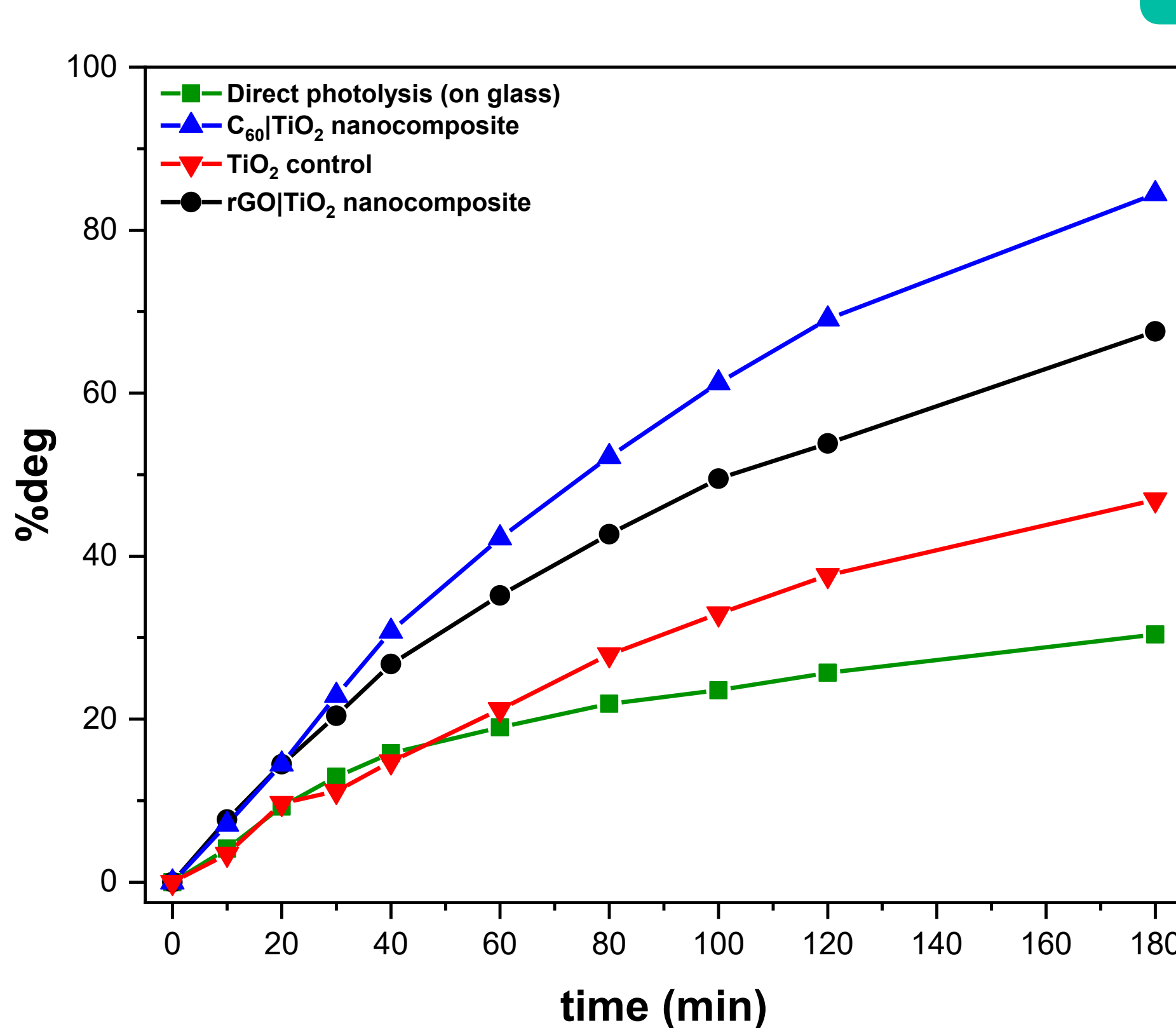
- Plasma treatment efficient in producing better dispersion of C<sub>60</sub>
- Negative ζ POTENTIAL. The colloidal dispersion is stable.
- ζ POTENTIAL is lower than pristine C<sub>60</sub> dispersion: indicative of negatively charged groups

## AEROSOL-ASSISTED ATMOSPHERIC PRESSURE PLASMA DEPOSITION OF C<sub>60</sub>/TiO<sub>2</sub> NANOCOMPOSITE COATINGS - in collaboration with R. Comparelli and M.L. Curri

### Experimental Section



### Results



- Addition of C<sub>60</sub> enhances photocatalysis.
- C<sub>60</sub> provides better results if compared to previously studied rGO/TiO<sub>2</sub> nanocomposites

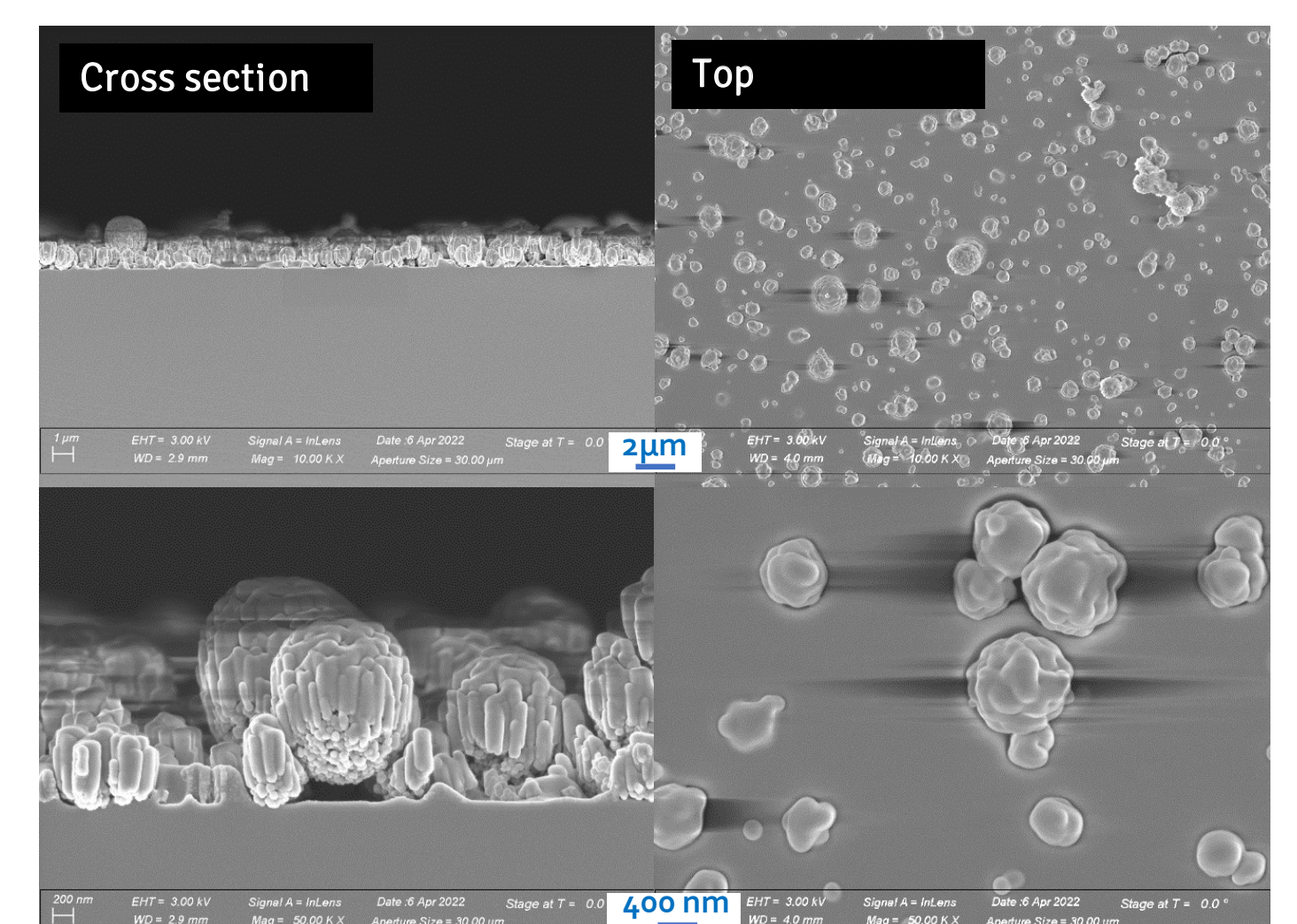
#### Thickness measurements

| Sample  | Avg. Thickness |
|---|----------------|
| rGO TiO <sub>2</sub> nanocomposite              | 870±140nm      |
| C <sub>60</sub>  TiO <sub>2</sub> nanocomposite | 1690±90 nm     |
| TiO <sub>2</sub> control                        | 1210±280nm     |

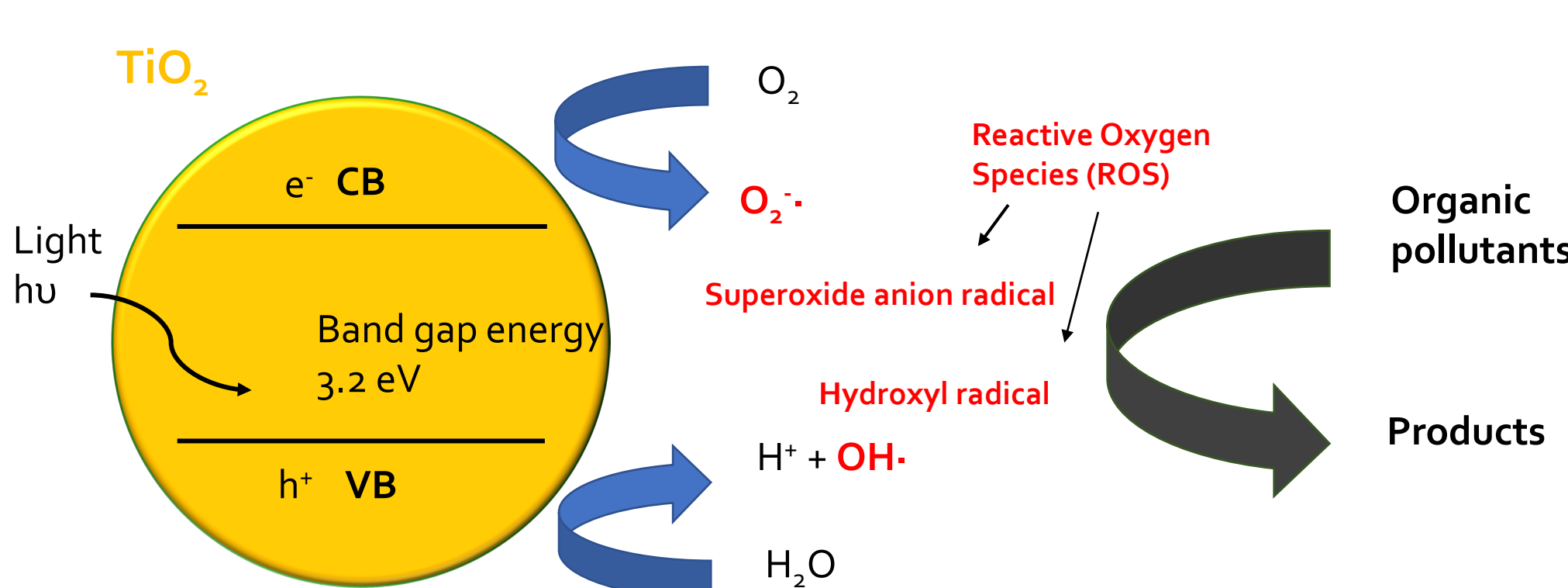
#### SEM/EDX Characterization

| C    | O    | Si   | Ti  | Ti/Si |
|------|------|------|-----|-------|
| 55.2 | 13.5 | 30.5 | 0.8 | 0.03  |

- At the moment it is difficult to ascribe the enhancement to composition (TiO<sub>2</sub> content %) or morphology/structure
- Further investigations necessary



#### UV methylene blue photodegradation



The addition of carbon nanomaterials slows down electron-hole recombination in TiO<sub>2</sub> and facilitates the transfer of photogenerated electrons from the conduction bands of TiO<sub>2</sub> to the nanomaterial

- Methylene blue 10<sup>-5</sup>M is used as model pollutant and photodegraded under UV lamp (λ>250nm, 30W)
- 15' of conditioning before photodegradation test