

# Fluorescence Probe for Determining the Ozone Dose Delivered by Plasmas

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Plasma composition is typically studied by absorption and emission spectroscopy, mass spectrometry and computational studies. While these techniques provide valuable information about the chemical species in the gas phase, in many applications it is desirable to have a direct measurement of the dose of chemical species delivered to a particular target. In this work, we will use a fluorescent chemical probe in order to characterize actual flux of ozone experienced by a target exposed to plasma.

The probe developed in this work (fig. 1) was derived from 2',7'-dichlorofluorescein (DCF). It works by having a homoallylic group appended to a DCF analogue that is essentially non-fluorescent. On exposure to ozone, rapid ozonolysis of the double bond in the side-chain proceeds, followed by loss of propenal and liberation of DCF, a fluorescent product. The amount of ozone can then be quantified by measuring the fluorescence after the plasma exposure.

To study its selectivity, the probe has been exposed to a range of reactive oxygen species (ROS) and none of them, except for ozone, resulted in an increase in fluorescence. This demonstrates the potential of the probe. Singlet oxygen in large scale, however, break down the compound causing the fluorescence disappear. Questions remain about the mechanisms and kinetics of this reaction, and these are subject of on-going investigations.

The probe developed here improves the performance of a previously reported DCF-derived probe for ozone detection<sup>2</sup> as it provides a more stable fluorescent product that does not readily react with ozone and/or other oxidative species in the plasma.

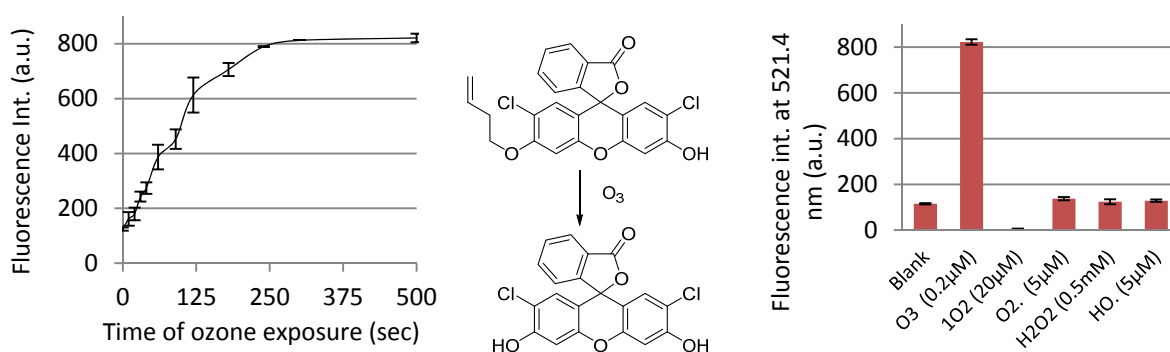


Figure 1: Left graph: Fluorescence of the product versus ozone exposure time. Right graph: Fluorescence of the product after exposure to various ROS. Middle graph: scheme of the reaction between the synthesized probe and ozone.

2. A. L. Garner, C. M. St Croix, B. R. Pitt, G. D. Leikauf, S. Ando and K. Koide, *Nature Chem*, 2009, **1**, 316-321.