Underwater discharge has been proposed in recent years as an alternative method for water treatment [1]. By generating the plasma in gas bubbles in the water, the contacting surface between the plasma and the water is increased, which is supposed to optimize the treatment process [2]. For a further improvement of the process efficiency, more information is needed about the fundamental mechanisms of the initiation and development of plasma inside bubbles. In this research, plasma inside a stationary bubble in grounded water on a metal capillary was generated. It was revealed that no plasma light emission could be measured during a variable period of time of several microseconds after application of the voltage pulse. The intensity of the emitted light depends on the bubble gas and is highest at the water-gas interphase during the whole process. This leads to the evaporation of the surrounding water and the development of streamer-like structures outside the gas volume (see Figure 1), causing the bubble to expand and dissociate. These results indicate that the plasma activity in a bubble is highest at the contacting surface with the water, which is favorable for the application of water treatment.

![Image of a discharge in a nitrogen bubble](image.png)

Figure 1: ICCD image of a discharge in a nitrogen bubble with a volume of 12 μl in distilled water with a conductivity of 12.2 μS/cm showing streamer-like structures inside the water. The voltage pulse of 28 kV is applied on the capillary, visible at the bottom. The image was recorded 60 μs after HV application with an exposure time of 5 μs.

References