Abstract Submitted
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Modelling plasma-produced reactive species delivery and scaling via prostate biopsy needles for application in prostate cancer therapy[1] ANDREW R. GIBSON, SANDRA SCHROETER, TIMO GANS, University of York, MARK J. KUSHNER, University of Michigan, DEBORAH O'CONNELL, University of York — The potential of non-thermal plasmas in biomedicine for applications from wound healing to cancer therapy is well-established. Reactive oxygen and nitrogen species (RONS) are thought to be key, and therefore controlled delivery of defined concentrations of RONS is likely to be crucial for the success of these applications. Presented here is a numerical study, carried out using the 0-D plasma-chemical kinetics code, GlobalKin, of RONS delivery via prostate biopsy needles for applications in prostate cancer therapy. Temporal variations in species densities are converted to a spatial variation down the needle length assuming plug-flow. An experimentally validated $He/H_2O/O_2$ plasma-chemical reaction mechanism is employed to describe reactive species formation and consumption. Reactive species scaling is investigated with respect to needle radius and length, power deposition, gas flow rate and the content of H_2O and O_2 in the He feed gas. The gas velocity in the needle is found to be a crucial factor in determining the reactive species composition of the gas reaching the end of the needle by determining the residence time of the gas in the plasma and the afterglow. Therefore, the flow rate act as a simple control parameter for the reactivity of the gas in applications.

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