Abstract Submitted
for the GEC20 Meeting of
The American Physical Society

Blending machine learning and thermal engineering for plasma diagnostics: A predictive modeling study using plasmid DNA.[1] AMAL SEBASTIAN, SYLWIA PTASINSKA, University of Notre Dame — Atmospheric pressure plasma (APP) is emerging as a potential candidate for numerous applications ranging from medicine to material processing. Due to many process parameters involved during the plasma interaction with the target, choosing the ideal parameter combinations for these applications is often challenging. The knowledge of reactive species delivery and thermal properties of plasma at each parameter is an inevitable key to solve this problem. The plasma-induced strand breaks and denaturation occurring in DNA can hint on the reactive species delivery and plasma gas temperature, respectively. We propose a supervised machine learning model to predict these plasma treatment-induced changes occurring in a plasmid DNA target. The predictive modeling was performed primarily using an artificial neural network (ANN) architecture, and a physical constraint based on treatment time was integrated into ANNs. The potential changes in the predicted strand breaks and denaturation with APP parameters were investigated. A novel methodology to deduce the plasma gas temperature by blending a heat transfer model and predictive model will be discussed. The optimal parameter choices that could be ideal for plasma medicine applications was proposed out from predictive modeling results.

[1]This material is based upon work supported by the U.S. Department of Energy Office of Science, Office of Basic Energy Sciences under Award number DE-FC02-04ER15533

Amal Sebastian
University of Notre Dame

Date submitted: 24 Jul 2020 Electronic form version 1.4