High-temperature oxidation of acetylene by N_2O behind shock waves

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The high-temperature chemistry of acetylene resides at a crossroads of combustion pathways. On the one hand, the heavier hydrocarbon fuel is oxidized to C2 compounds, which are further converted to C1 and ultimately to CO and end products. On the other hand, acetylene is an important intermediate and a building block in the formation of polycyclic aromatic hydrocarbon (PAH) and soot. It is worth noting that even predicting the combustion kinetics of acetylene itself is still experiencing difficulties. In this regard, this work is devoted to the study of high-temperature oxidation of acetylene (C_2H_2) by nitrous oxide (N_2O) behind reflected shock waves. Atomic resonance absorption spectrometry (ARAS) is employed to record oxygen atom concentration profiles for the mixture of 10 ppm C_2H_2 + 10 ppm N_2O + argon and temperatures from 1688 to 3179 K, extending the range of such data available from the literature. Based on the data obtained, an updated detailed kinetic mechanism is presented for modeling and analysis of the results, and the selection of rate constants in the C_2H_2 sub-mechanism, whose importance was identified by the sensitivity analysis, is discussed. The performance of the new model is compared against several reaction schemes available from the literature, and kinetic differences between them are outlined. The new shock-wave data helped to improve the performance of the present model compared to its previous version.