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NOx Emissions from a Rotating Detonation-wave Engine. KAZHIKATHRA KAILASANATH, DOUGLAS SCHWER, U.S. Naval Research Laboratory — Rotating detonation-wave engines (RDE) are a form of continuous detonation-wave engines. They potentially provide further gains in performance than an intermittent or pulsed detonation–wave engine (PDE). The overall flow field in an idealized RDE, primarily consisting of two concentric cylinders, has been discussed in previous meetings. Because of the high pressures involved and the lack of adequate reaction mechanisms for this regime, previous simulations have typically used simplified chemistry models. However, understanding the exhaust species concentrations in propulsion devices is important for both performance considerations as well as estimating pollutant emissions. Progress towards addressing this need will be discussed in this talk. In this approach, an induction parameter model is used for simulating the detonation but a more detailed finite-chemistry model including NOx chemistry is used in the expansion flow region, where the pressures are lower and the uncertainties in the chemistry model are greatly reduced. Results show that overall radical concentrations in the exhaust flow are substantially lower than from earlier predictions with simplified models. Results to date show that NOx emissions are not a problem for the RDE due to the short residence times and the nature of the flow field. Furthermore, simulations show that the amount of NOx can be further reduced by tailoring the fluid dynamics within the RDE.

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