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The Interaction of High-Speed Turbulence with Flames: Turbulent Flame Speed ALEXEI POLUDNENKO, ELAINE ORAN, Naval Research Laboratory — The interaction of flames with background turbulence occurs in systems ranging from chemical flames on Earth to thermonuclear burning fronts in supernovae. We present an analysis of a set of numerical simulations aimed at studying the dynamics and properties of turbulent flames formed under the action of high-speed turbulence in stoichiometric hydrogen-air mixture. The simulations were performed using the massively parallel reactive-flow code Athena-RFX. Previous analysis of these simulations showed that this system represents turbulent combustion in the thin reaction zone regime even in the presence of intense turbulence (Da = 0.05, $U_{rms} \sim 35$ times the laminar flame speed). Here we discuss the processes that determine the turbulent burning velocity and show that it exceeds values that can be attributed only to the increase of the flame surface area. We suggest a possible mechanism for this excess burning rate. Finally, we discuss the implications of these results for the process of deflagration-to-detonation transition in unconfined systems. This work was supported in part by AFOSR, NRL, ONR, and by NSF through the TeraGrid resources.

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