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Alignment of principal strain rates, vorticity, and scalar gradients in a turbulent nonpremixed jet flame ANTONIO ATTILI, FABRIZIO BISETTI, King Abdullah University of Science and Technology — The alignment of vorticity and gradients of conserved and reactive scalars with the eigenvectors of the strain rate tensor (i.e., the principal strains) is investigated in a direct numerical simulation of a turbulent nonpremixed flame achieving a Taylor's scale Reynolds number in the range $100 \leq \mathrm{Re}_\lambda \leq 150$ [Attili *et al.* Comb. Flame, 161, 2014]. The vorticity vector displays a pronounced tendency to align with the direction of the intermediate strain. These alignment statistics are in almost perfect agreement with those in homogeneous isotropic turbulence [Ashurst *et al.* Physics of Fluids 30, 1987] and differ significantly from the results obtained in other nonpremixed flames in which vorticity alignment with the most extensive strain was observed [Boratav *et al.* Physics of Fluids 8, 1996]. The gradients of conserved and reactive scalars align with the most compressive strain. It is worth noting that conditioning on the local values of the mixture fraction does not affect the statistics. Our results suggest that turbulence overshadows the effects of heat release and chemical reactions. This may be due to the larger Reynolds number achieved in the present study compared to that in previous works.

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