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Effect of flow topology on enstrophy production and scalar structures in chemically reacting compressible isotropic turbulence[1] JIAN TENG, JIANCHUN WANG, Southern University of Science and Technology, HUI LI, Wuhan University, SHIYI CHEN, Southern University of Science and Technology — Flow topology in hydrogen-air chemically reacting compressible isotropic turbulence is studied by using numerical simulations at turbulent Mach numbers ranging from 0.2 to 0.8. Various statistical properties of eight flow topologies based on the three invariants of velocity gradient tensor are investigated with a specific focus on the effect of flow topology on enstrophy production and scalar structures. It is found that the topologies unstable focus/compressing (UFC), unstable node/saddle/saddle ($UN/S/S$) and stable focus/stretching (SFS) are predominant flow patterns. The volume fractions of the topologies stable node/saddle/saddle ($SN/S/S$) and unstable node/unstable node/unstable node ($UN/UN/UN$) increase apparently at low turbulent Mach number M_t=0.2 due to strong heat release. The topologies $UN/S/S$ and SFS have major contributions to the overall enstrophy production. Moreover, the curvatures of temperature isosurfaces are studied. It is found that during the reaction process, the magnitude of average Gauss curvature increases evidently at M_t=0.2 and 0.4, resulting a predominant saddle scalar surface geometry. The topologies $UN/S/S$, SFC and UFS have major contributions to the increase of mean and Gauss curvatures.

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