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Mixing in magnetohydrodynamic turbulence[1] X.M. 'SHINE' ZHAI, Numeca-USA, P. K. YEUNG, KIRAN RAVIKUMAR, Georgia Institute of Technology — Turbulence is characterized by its ability to efficiently promote scalar mixing, which occurs at the molecular level as large scale non-uniformities are broken into ever smaller pieces accompanied by a classical energy cascade. Yet for electrically conducting fluid subject to a strong magnetic field, anisotropy develops in all scales of turbulence and energy cascade is inhibited (Zhai & Yeung, PRF 2018). As a result, scalar mixing in magnetohydrodynamic (MHD) turbulence is expected to show distinctly different behaviors. We have performed direct numerical simulations of scalar mixing in MHD turbulence under a mean scalar gradient. When a magnetic field is present, mixing of scalars in liquid metals, which has a Schmidt number of $\mathcal{O}(0.01)$, is weakened as scalar variances grow more slowly. Variances of scalar gradients grow faster for less diffusive scalars, but gradient fluctuations in the direction of the magnetic field are suppressed. The largest simulations for passive scalars were performed at a resolution of 8192×2048^2 on a domain size of $32\pi \times (4\pi)^2$. The case of active scalars is also briefly addressed.

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