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Subgrid-scale mixing of temperature perturbations from flamelet in turbulent partially premixed flames SHUAISHUAI LIU, CHENNING TONG, Clemson University — Recent studies have shown that the subgrid-scale (SGS) mixture fraction and temperature in turbulent partially premixed flames have different structures for different SGS scalar variance. For large SGS variance the molecular transport and chemical reaction are tightly coupled while mixing models are greatly based on non-reactive scalars. To account for this coupling effect we use a method proposed by Bilger and Pope [1, 2] to decompose the temperature (a reactive scalar) into a flamelet part and the perturbations from it. The molecular transport of the former is in close form while the latter in unclosed. The diffusion and dissipation of the temperature perturbations are analyzed using high-resolution line images obtained in turbulent partially premixed (Sandia) flames. The results show that for flame regions that are nearly fully burning, the SGS mixing of the temperature perturbations is similar to that of a non-reactive scalar.

[1] R.W. Bilger. Combust. Sci. Tech., 22 (1980) 251-261.
[2] S.B. Pope. Prog. Energy Combust. Sci., 11 (1985) 119-192.

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