GBOLAHAN IDOWU, ABDULAFEEZ ADEBIYI, and V'YACHESLAV AKKERMAN, Dept. of Mechanical and Aerospace Engineering, West Virginia University, Morgantown, WV, 26506. Effect of Nonequidiffusivity on Flame Acceleration in Obstructed Channels.

The mechanism of ultrafast acceleration of a premixed flamefront propagating in a channel equipped with a "tooth-brush"-shaped array of tightly-packed obstacles has been revealed and quantified, analytically, and validated by means of the computational simulations [Bychkov *et al.*, Phys. Rev. E (2008) 164501]. However, the Bychkov theory and modeling employed various simplifications, including that of equidiffusive combustion, where the thermal-to-mass diffusivities ratio (the Lewis number, *Le*) is unity. Nevertheless, real flames are usually nonequidiffusive, which is addressed in the present work. Specifically, the impact of *Le*, in the range $0.2 \le Le \le 2.0$, on flame acceleration in obstructed channels is investigated by means of the extensive numerical simulation of the reacting flow equations with fully-compressible hydrodynamics and Arrhenius chemical kinetics. A detailed parametric study is performed for the blockage ratio (BR) in the range 1/3~2/3, the spacing between the obstacles being z/R = 1/4~1/2, and the channel width *D* in the range $48 \le D/L_f \le 96$, where L_f is the thermal flame thickness. A key role of *Le* is shown in all considered cases. Specifically, due to a flamefront thickening, the Le > 1 flames accelerate slower as compared to the equidiffusive ones. In contrast, the Le < 1 flames acquire stronger distortion of the front shape and thereby accelerate much faster than the equidiffusive flames. We relate the latter effect to the onset of the diffusional-thermal combustion instability.