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Acoustically-Coupled Combustion Dynamics of Laminar Microjet Diffusion Flames[1] ANDRES VARGAS, JOSE GUERRERO, ANN KARAGOZIAN, HYUNG SUB SIM[2], University of California, Los Angeles — The present experiments focus on the response of burning gaseous fuel jets to prescribed transverse acoustic excitation as a means of exploring the coupling of reactive, acoustic, and flow processes relevant to combustion instabilities. Microjets with several alternative configurations and sizes (including single and multiple jets) and different fuels are exposed to transverse standing wave disturbances within an acoustic waveguide for which a range of resonant frequencies and amplitudes of excitation are applied. Temporal flame response to acoustic excitation is studied via OH* chemiluminescence and visible imaging, with quantification of the dynamics via proper orthogonal decomposition (POD), Rayleigh indices, and temporal flame distortion measurements. Characteristic signatures associated with various types of flame response are identified, including weakly oscillatory combustion, full-scale flame lock-in to excitation, and multi-mode flame dynamics preceding flame extinction. Phase space plots of dominant POD mode coefficients produce periodic as well as strange attractor-like shapes for high amplitude forcing.

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