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Measurements of $N_2(A^3\Sigma_u^+,v=0)$ Populations in a Nonequilibrium Supersonic Flow Wind Tunnel ELIJAH JANS, ILYA GULKO, TERRY MILLER, IGOR ADAMOVICH, The Ohio State University — Absolute time-resolved population of $N_2(A^3\Sigma_u^+,v=0)$ electronic state has been measured in the plenum of a Mach 5 blowdown wind tunnel by Tunable Diode Laser Spectroscopy (TDLAS). $N_2(A)$ is generated in the plenum of the wind tunnel using a ns pulse generator (30 kV, FWHM 10 ns), operated at a pulse repetition rate from 4 to 100 kHz. The wind tunnel is operated at the plenum pressure of P_0 =227 Torr, with the flow expanding to a static pressure of P=1.15 Torr in the test section, corresponding to the Mach number of 4.2. During the run, the laser wavelength is tuned to the peak absorption of the overlapping transitions $Q_1(18)$ and $Q_3(8)$ in the $N_2(B,v=2\leftarrow A,v=0)$ band, at 771.417 nm, and the absorption signal is measured during the discharge burst and in the afterglow. At 4 kHz pulse repetition rate, $N_2(A,v=0)$ population peaks at $1.6\text{x}10^{13}$ cm^{-3} after each discharge pulse, , and decays between the pulses almost completely. At 100 kHz pulse repetition rate, $N_2(A,v=0)$ population increases during the first 5 pulses, peaking at $4\text{x}10^{13}$ cm^{-3}, and then begins to decay before leveling off after 100 pulses. Comparison with kinetic modeling is expected to provide insight into the mechanism of $N_2(A)$ excitation and decay at these conditions.

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