abstract We report on a 39 ks observation of the 7.7-s low-mass X-ray binary pulsar 4U 1626−67 with the High Energy Transmission Grating Spectrometer (HETGS) on the Chandra X-Ray Observatory. This ultracompact system consists of a disk-accreting magnetic neutron star and a very low mass, hydrogen-depleted companion in a 42-min binary. We have resolved the previously reported Ne/O emission line complex near 1 keV into Doppler pairs of broadened (≈2500 km s$^{-1}$ FWHM) lines from highly ionized Ne and O. In most cases, the blue and red line components are of comparable strength, with blueshifts of 1550–2610 km s$^{-1}$ and redshifts of 770–1900 km s$^{-1}$. The lines appear to originate in hot (≈10$^6$ K), dense material just below the X-ray–heated skin of the outer Keplerian accretion disk, or else possibly in a disk wind driven from the pulsar’s magnetopause. The observed photoelectric absorption edges of Ne and O appear nearly an order of magnitude stronger than expected from interstellar material and are likely formed in cool, metal-rich material local to the source. Based on the inferred local abundance ratios, we argue that the mass donor in this binary is probably the 0.02 $M_\odot$ chemically fractionated core of a C-O-Ne or O-Ne-Mg white dwarf which has previously crystallized.