The photochemistry of biacetyl in an inert gas matrix was investigated using infrared spectroscopy. Fourier Transform Infrared Spectra of biacetyl, CH$_3$COCOCH$_3$, in nitrogen, oxygen, argon, krypton, and xenon were taken at temperatures ranging from 12-100 K and high vacuum conditions, on the order of 10$^{-6}$ Torr. The systems were exposed to ultraviolet photolysis and laser irradiation over various time periods and temperature increments. Analysis of the spectra indicate the formation of acetyl, carbon monoxide, and methyl radicals, as well as formaldehyde, acetylene, and cis-biacetyl. The acetyl vibrations occur at substantially lower frequencies than those reported by Jacox. Temperature dependence of the spectra in argon and xenon matrices was observed in order to investigate the effect of temperature on the molecule's vibrational dynamics. The loss of the inert gas, leaving solid biacetyl, was observed for xenon.