

Vibrational Coherence Spectroscopy of the Heme Domain in the CO-Sensing Transcriptional Activator CooA

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Description

Femtosecond vibrational coherence spectroscopy was used to investigate the low-frequency vibrational dynamics of the heme in the carbon monoxide oxidation activator protein (CooA) from the thermophilic anaerobic bacterium *Carboxydothemus hydrogenoformans* (Ch-CooA). Low frequency vibrational modes are important because they are excited by the ambient thermal bath ($kBT = 200 \text{ cm}^{-1}$) and participate in thermally activated barrier crossing events. However, such modes are nearly impossible to detect in the aqueous phase using traditional spectroscopic methods. Here, we present the low frequency coherence spectra of the ferric, ferrous, and CO-bound forms of Ch-CooA in order to compare the protein-induced heme distortions in its active and inactive states. Distortions take place predominantly along the coordinates of low-frequency modes because of their weak force constants, and such distortions ...