SPECTRAL AND HYDRATION DEPENDENCE OF PROTEIN DYNAMICAL TRANSITION

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The protein dynamical transition, a rapid increase in flexibility at approximately 200 K, is hydration dependent suggesting that the transition may in fact be due to a transition in the surrounding water. Previously we have shown that the terahertz dielectric response is sensitive to the dynamical transition using terahertz time domain spectroscopy. The broadband technique allows the determination of what motions are affected by the transition, that is whether long time scale motions such as side chain rotations, or faster vibrational motions. Here we examine both the frequency and hydration dependence of the protein dynamical transition for hydrated myoglobin powder for the 0.2-2.0 THz and 80-295 K ranges. The transition is observed in both the real and imaginary parts of the dielectric response. Our earlier measurements of solutions did not show a transition in the real part of the permittivity, likely due to bulk solvent dominating the index. There is a strong frequency dependence with hydration. While a slight transition is observed at frequencies higher than 1 THz which is nearly hydration independent, for frequencies below 1 THz the strength of the transition rapidly increases with hydration.