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Internal dynamics of different folding intermediates of apo-myoglobin

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During protein folding different intermediate states occur with varying content of secondary structural elements. Regions lacking well-defined structure exist as well in unfolded and partially folded systems. In order to characterize their dynamics, we studied apo-myoglobin in different folding states [1,2,3]. We investigated internal dynamics of its unfolded form on a time-scale up to several hundred nanoseconds and in the nanometer length-scale using neutron spin echo spectroscopy (NSE) at the instrument SNS-NSE in Oak Ridge[4]. We measured the folded protein with NSE on the same time scales for comparison at the J-NSE "Phoenix"at MLZ. Aggregation state and center of mass diffusion were monitored in both cases in parallel with dynamic light scattering. Information on the form and structure factor was obtained by small angle neutron scattering (SANS) at KWS-2 at MLZ. Whereas the dynamics of the folded protein is dominated by center of mass diffusion, our first NSE data of the unfolded protein state shows a polymer-like behavior. This indicates that powerful polymer models well-established in the field of soft matter may be used to describe such protein systems.

[1] J. Phys. Chem. B, 2015, 119 (1), 72
[2] J Mol. Biol., 1996, 263(4), 531
[3] J. Am. Chem. Soc., 2014, 136 (19), 6987
[4] Richter D. et al., 2005, Neutron Spin Echo in Polymer Systems. Advances in Polymer Science, vol 174. Springer, Berlin, Heidelberg

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