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Slow Domain Motions of an Oligomeric Protein from Deep-Sea Hyperthermophile probed by Neutron Spin Echo DEBSINDHU BHOWMIK, UTSAB SHRESTHA, GURPREET DHINDSA, Wayne State University, MELISSA SHARP, European Spallation Souce, LAURA R. STINGACIU, Oak Ridge National Laboratory, XIANG-QIANG CHU, Wayne State University, XIANG-QIANG CHU TEAM — Deep-sea microorganisms have the ability to survive under extreme conditions, such as high pressure and high temperature[1]. In this work, we used the combination of the neutron spin-echo (NSE) and the small angle neutron scattering (SANS) techniques to study the inter-domain motions of the inorganic pyrophosphate (IPPase) enzyme derived from thermostable microorganisms Thermococcus thioreducens. The IPPase has hexameric quaternary structure with molecular mass of approx. 120kDa (each subunit of 20kDa), which is a large oligomeric structure. The understanding of its slow inter-domain motions can be the key to explain how they are able to perform catalytic activity at higher temperature compared to mesophilic enzymes, thus leading to adapt to extreme environment present at the seabed [1]. The NSE can probe these slow motions directly in the time domain up to several tens of nanoseconds at the nanometers length scales, while the corresponding structural change can be explored by the SANS [2]. Our results provide a better picture of the local flexibility and conformational substates unique to these types of proteins, which will help us better understandthe relation between protein dynamics and their biological activities. [1] U. R. Shrestha, et. al, PNAS (2015); X.-Q. Chu, et. al, JPCB 116, 9917 (2012). [2] R. Biehl, et. al, Soft Matt. 7, 1299 (2011)

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