Re-entrance of Poly(N,N-diethylacrylamide) in D$_2$O/d-Ethanol Mixture at 27 °C.\textsuperscript{1} HE CHENG, Institute of High Energy Physics CAS — The re-entrance of poly(N,N-diethylacrylamide) (PDEA) in D$_2$O/d-ethanol mixtures (i.e., the coil-to-spherical aggregates-to-coil transition) has been observed at 27 °C by small-angle neutron scattering (SANS). PDEA has a lower critical solution temperature (LCST) phase diagram in the D$_2$O rich region and is soluble in the D$_2$O-poor region for all of the observed temperature ranges. Its spinodal temperature decreases first from 33.5 °C in pure D$_2$O to 26.7 °C in 80% D$_2$O/20% d-ethanol and then increases to 283.1°C in 50% D$_2$O/50% d-ethanol. With the further decrease of D$_2$O content, PDEA dissolves well, and its phase boundary can no longer be observed by SANS. The ternary random phase approximation model (RPA) is used to analyze the SANS profiles, and three Flory–Huggins interaction parameters ($\chi_{\text{PDEA}d\text{ethanol}}$, $\chi_{\text{PDEA}D_2O}$ and $\chi_{d\text{ethanol}D_2O}$) are obtained. When a small amount of d-ethanol is added to the system, it has a strong interaction with D$_2$O, so it directly gets distributed into the water structure and makes a negative contribution to the dissolution of PDEA ($\chi_{d\text{ethanol}D_2O}$ is much smaller than $\chi_{\text{PDEA}d\text{ethanol}}$ and $\chi_{\text{PDEA}D_2O}$). Neither d-ethanol nor D$_2$O wants to help the dissolution of PDEA in the first place, until the structure of mixed solvents tends to be pure d-ethanol in the D$_2$O-poor region.

\textsuperscript{1}The financial support from the UK-China Newton project, and National Natural Scientific Foundation of China (No. 21474119) are gratefully acknowledged.

He Cheng
Institute of High Energy Physics CAS

Date submitted: 30 Oct 2016

Electronic form version 1.4