**Electronic Supplementary Information (ESI)**

**Thermo-Reversible, Ergodicity and Surface Charge-Temperature Dependent Phase Diagram of Anionic, Cationic and Neutral Co-Gels of Gelatin-BSA Complexes**

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**Figure S1**: Temporal variation of the light scattered intensity of the gelling solutions shown as function of time during cross linking process of the (BSA-GB) systems for (a) cationic (pH = 3) and (b) anionic (pH = 7) at mixing ratio \( r = 1.5, 2, 3, 4 \) scattering angle of \( \theta = 90^\circ \) at 20°C. Note the rampant fluctuations in intensity close to onset of gelation. Arrow indicates the sol–gel transition. Note the faster gelation for anionic gel than cationic gels at all mixing ratios.
Figure S2: The evolution of dynamic structure factor of the cationic samples at pH=3 with (a) r=1.5, (b) r=2, (c) r=3 and (d) r=4.0. The arrow indicates the evolution of structure factor starting \( t_w=0 \)h to \( t_w=t_{gel} \)h at pH=3.
**Figure S3:** Variation of fast ($\tau_f$) and slow ($\tau_s$) reaction time samples for pH=3 and pH=7 as a function of reaction time in equation (2) and (3). Open symbols indicate fast relaxation time while filled symbols indicate slow relaxation time.
Figure S4: The evolution of decay rate distribution functions obtained for samples with $r=1.5$, 2.0, 3.0 and 4.0 before and after gelation as a function of time at pH= 3.
**Figure S5:** (a) Variation of heterodyne contribution $\chi$ at pH 3 shown as a function of waiting time /sec. The point where there is slop changes in the value of $\chi$ is defined as aerodicity breaking time $\tau_{\text{EB}}$. (b) The aerodicity breaking time ($\tau_{\text{EB}}$) and gelation time ($t_g$) of samples as a function of mixing ratio $r$ at pH 3.

**Figure S6:** (a) Storage $G'(\omega)$ modulus of gel as a function of frequency. (b) Storage modulus $G'(\omega)$ of gel as a function of temperature. Sharp drop indicates a melting temperature. The measurements were performed at 25 °C using a constant oscillation stress of 1 Pa. Solid lines is guides to the eye.
Figure S7: The evolution of dynamic structure factor of the samples with (a) r=1.5, (b) r=2, (c) r=3 and (d) r=4.0 for anionic gels (pH=7). The arrow indicates the evolution of structure factor starting $t_w=0$ to $t_w=t_{gel}$ at pH=7.

Figure S8: (a) Variation of heterodyne contribution $\chi$ at pH 3 shown as a function of waiting time /sec. The point where there is slop changes in the value of $\chi$ is defined as aergodicity breaking time $\tau_{EB}$. (b) The aergodicity breaking time ($\tau_{EB}$) and gelation time ($t_{gel}$) of samples as a function of mixing ratio $r$ at pH 7.
**Figure S9:** The evolution of decay rate distribution functions obtained for samples with $r=1.5$, 2.0, 3.0 and 4.0 before and after gelation as a function of time at pH= 7.

**Figure S10:** (a) Storage $G'(\omega)$ modulus of gel as a function of frequency. (b) Storage modulus $G'(\omega)$ of gel as a function of temperature. Sharp drop indicates a melting temperature. The measurements were performed at 25 °C using a constant oscillation stress of 1 Pa. Solid lines is guides to the eye.