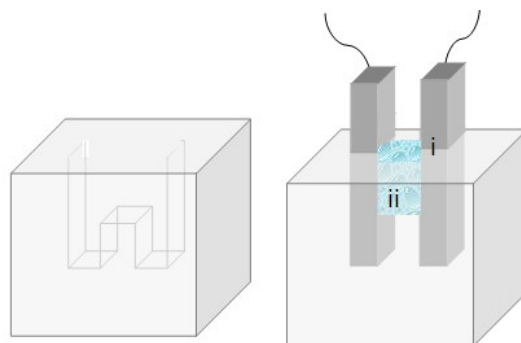
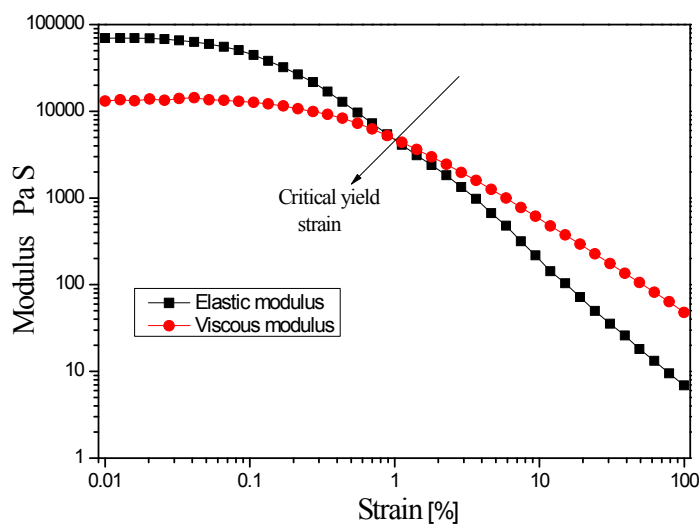


## A novel colloidal suspension of $\text{TBA}^+ \text{BF}_4^-$ - EG and its applications as a soft solid electrolyte

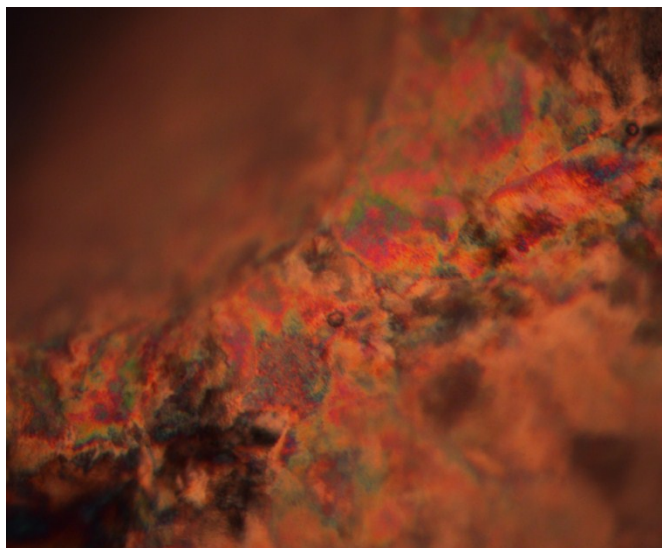
Anu Renjith and V. Lakshminarayanan\*



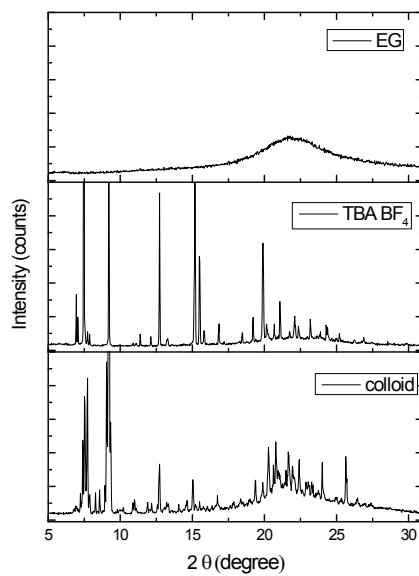
**Figure S1.** (a) Teflon container (b) components of the electrochemical cell (i) Pt foils (ii) colloidal matrix in the teflon container used for the electrochemical monitoring of enzyme-kinetics.



**Figure S2.** Strain response of the colloid at a frequency of 0.5rad/s



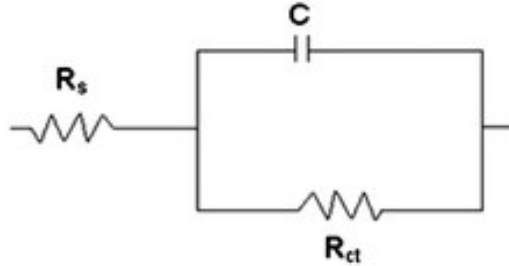
**Figure S3.** POM textures of the gel at room temperature showing the crystalline nature of the colloid. The images were taken under crossed polarisers at 5x magnification



**Figure S4.** XRD patterns of the colloid, TBABF<sub>4</sub>, EG at room temperature

**Ionic conductivity measurements:**

The ionic conductivity measurements of the colloidal matrix were carried out by considering the electrode-colloid interface analogous to a simple Randles equivalent circuit with a parallel combination of double layer capacitance and charge transfer resistance in series with the solution resistance. (Bard and Faulkner, 2000)



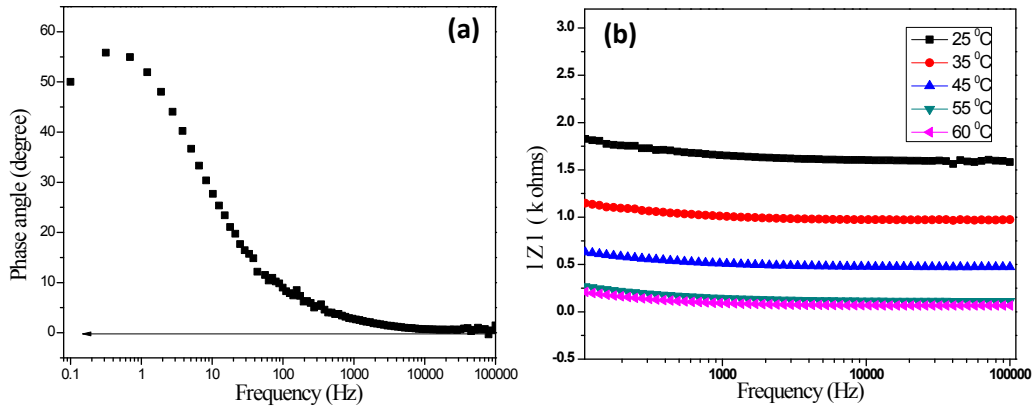
For a Randles circuit with a resistor and capacitor in parallel, the real component of impedance,

$$Z_{re} = R_s + \frac{R_{ct}}{1 + \omega^2 C_d^2 R_{ct}^2} \quad \text{----- (S1)}$$

$$Z_{im} = \frac{\omega C_d R_{ct}^2}{1 + \omega^2 C_d^2 R_{ct}^2} \quad \text{----- (S2)}$$

At high frequencies,  $\frac{1}{\omega C_d} \rightarrow 0$ , Hence,  $Z_{re} = R_s$  and  $Z_{im} = 0$

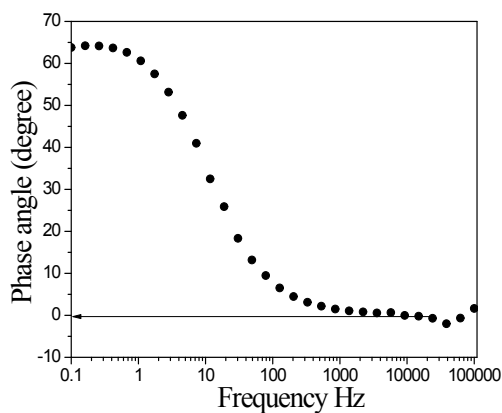
The ionic conductivity is calculated from  $\sigma = L / A R_s$  where  $A$  and  $L$  represent the cross sectional area and thickness between the Pt plates and  $R_s$  denotes the solution resistance. It can very well be observed from the Bode phase diagram Fig.S5a, that at frequencies greater than 6kHz, the phase angle tends to zero indicating that the capacitive contribution is negligible. Hence the solution resistance was obtained from the Bode plots at a frequency of 10kHz given in Fig.S5b.



**Figure S5.** (a) Phase angle Bode plot of the colloid at room temperature (b) Bode plots at different temperatures

### Electrochemical procedure followed for monitoring enzyme kinetics

The urease-urea reaction was electrochemically monitored as follows. A known weight of urea was dissolved in the colloidal matrix at temperatures greater than 50 °C to prepare different concentrations of substrates. From each concentration, 110µL is pipetted into the sample well. The urea dissolved in the colloid matrix was allowed to equilibrate in the electrochemical cell. The enzyme (1µL of 1mg/ml aqueous solution of urease) was added to the matrix and the real time monitoring of ionic conductance with the progress of the reaction was carried out as discussed in the previous section. The ionic conductance was obtained at a frequency of 20kHz where the phase angle is zero as given in the Bode phase diagram in Fig.S6.



**Figure S6.** Phase angle Bode plot of colloid matrix under experimental conditions at room temperature

### Michaelis - Menten Equation

The data obtained was fitted to Michaelis-Menten equation,

$$v = \frac{V_{\max} [S]}{K_m + [S]} \quad \text{----- (S2)}$$

Where  $V_{\max}$  represents the maximum velocity achieved by the system,  $[S]$  is the substrate concentration and  $K_m$  is the Michaelis constant.

For an enzyme – substrate reaction,



$$K_m = \frac{k_{-1} + k_2}{k_1} \quad \text{----- (S3)}$$


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