Supporting Information

AC Conductivity Study of Mechanochemical Synthesized Solid Electrolytes of $Li_{6-a}M^{n}_{a/n}PS_5Cl$ (M = Ca, Mg, Ba, Zn, Al, Y)

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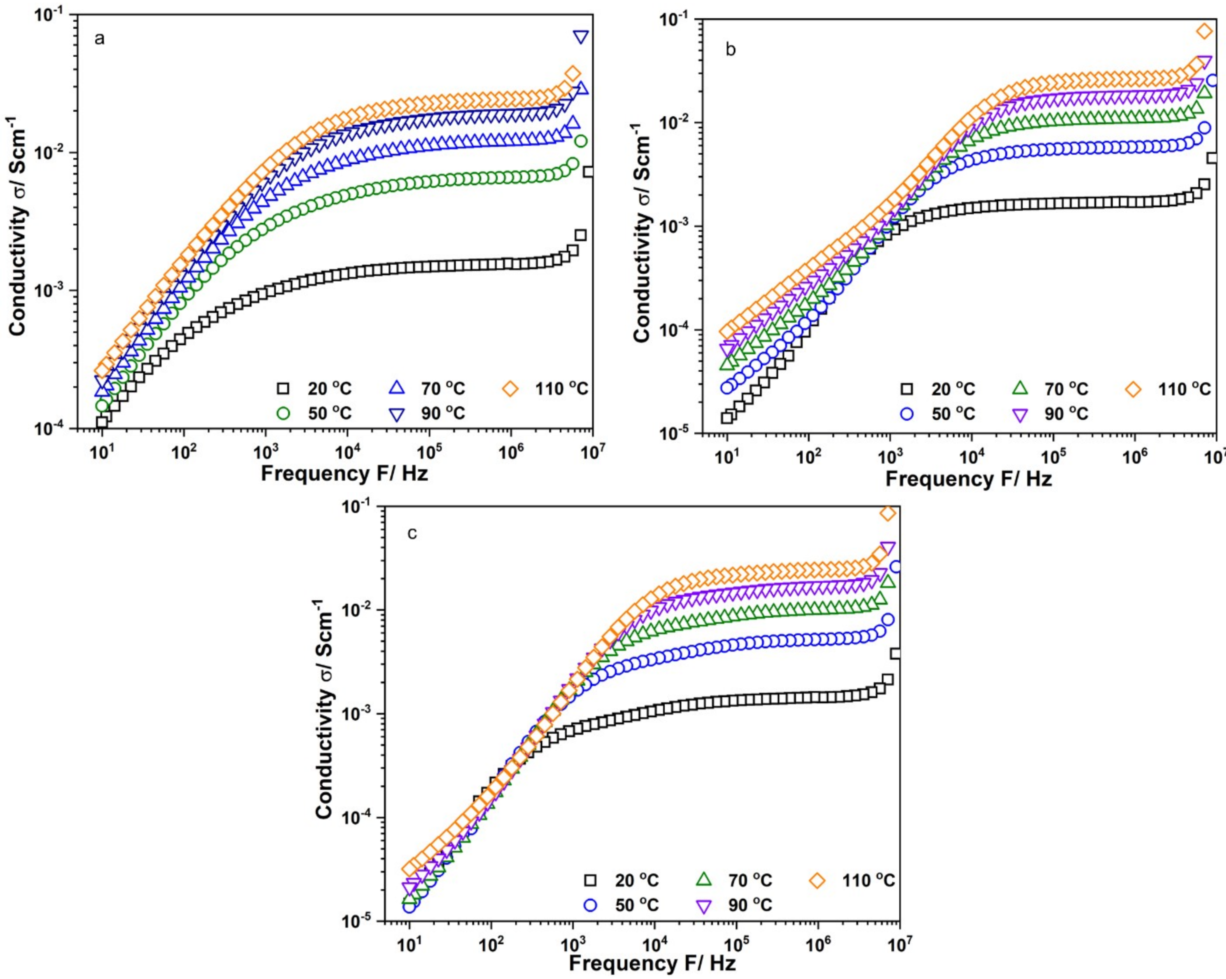

Figure S1: Conductivity isotherms of (a) $Li_{5.96}Ca_{0.002}$ PS_5Cl; (b) $Li_{5.9}Ca_{0.05}$ PS_5Cl and (c) $Li_{5.8}Ca_{0.1}$ PS_5Cl measured from 10 Hz to 9 MHz.

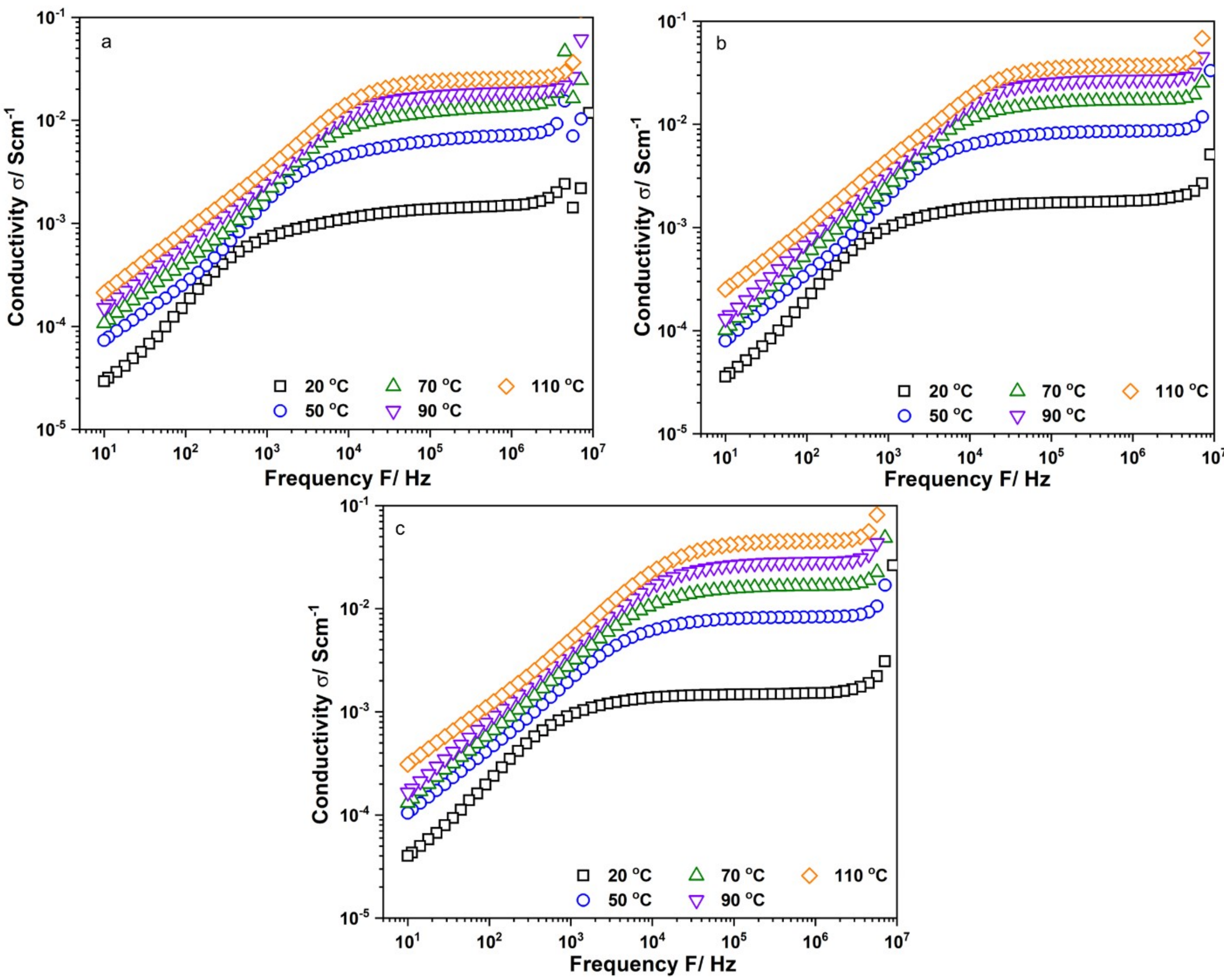

Figure S2: Conductivity isotherms of (a) $Li_{5.94}Ba_{0.03}$ PS_5Cl; (b) $Li_{5.94}Zn_{0.03}$ PS_5Cl and (c) $Li_{5.94}Y_{0.02}$ PS_5Cl measured from 10 Hz to 9 MHz.

Table S1: The values of A and n in $\sigma = \sigma_{DC} + A\omega^{n}$

	A					n				
	20 °C	50 °C	70 °C	90 °C	110 °C	20 °C	50 °C	70 °C	90 °C	110 °C
Li_6PS_5Cl	9.41×10^{-6}	8.26×10^{-5}	5.54×10^{-5}	3.63×10^{-5}	4.92×10^{-5}	0.241	0.1442	0.1594	0.2044	0.2122
$Li_{5.96}Ca_{0.002}\ PS_5Cl$	7.03×10^{-5}	2.22×10^{-3}	3.39×10^{-3}	4.59×10^{-3}	3.73×10^{-3}	0.106	0.045	0.0592	0.0571	0.0663
$Li_{5.94}Ca_{0.03}\ PS_5Cl$	3.77×10^{-4}	2.56×10^{-3}	3.98×10^{-3}	3.40×10^{-3}	5.35×10^{-3}	0.0528	0.0394	0.0532	0.088	0.0543
$Li_{5.9}Ca_{0.05}\ PS_5Cl$	2.46×10^{-4}	1.90×10^{-3}	1.55×10^{-3}	3.08×10^{-3}	5.06×10^{-3}	0.0478	0.0341	0.0913	0.0669	0.0629
$Li_{5.8}Ca_{0.1}\ PS_5Cl$	6.1×10^{-5}	8.64×10^{-4}	1.10×10^{-3}	2.08×10^{-3}	1.54×10^{-3}	0.105	0.0537	0.072	0.065	0.104
$Li_{5.94}Ba_{0.03}\ PS_5Cl$	1.90×10^{-4}	1.19×10^{-3}	2.00×10^{-3}	4.12×10^{-3}	6.33×10^{-3}	0.0887	0.0914	0.1062	0.0711	0.0543
$Li_{5.94}Zn_{0.03}\ PS_5Cl$	4.86×10^{-5}	2.06×10^{-3}	3.95×10^{-3}	6.74×10^{-3}	5.84×10^{-3}	0.1346	0.0405	0.0414	0.036	0.07
$Li_{5.94}Mg_{0.03}\ PS_5Cl$	3.91×10^{-5}	1.4×10^{-4}	1.02×10^{-4}	9.79×10^{-4}	3.04×10^{-3}	0.1109	0.1152	0.0699	0.1213	0.0895
$Li_{5.94}Al_{0.02}\ PS_5Cl$	1.43×10^{-5}	1.65×10^{-4}	6.25×10^{-5}	2.12×10^{-5}	1.40×10^{-5}	0.1988	0.1425	0.234	0.3356	0.3868
$Li_{5.94}Y_{0.02}\ PS_5Cl$	1.13×10^{-4}	1.83×10^{-3}	4.34×10^{-3}	8.68×10^{-3}	1.55×10^{-2}	0.0744	0.0434	0.0401	0.0371	0.0327

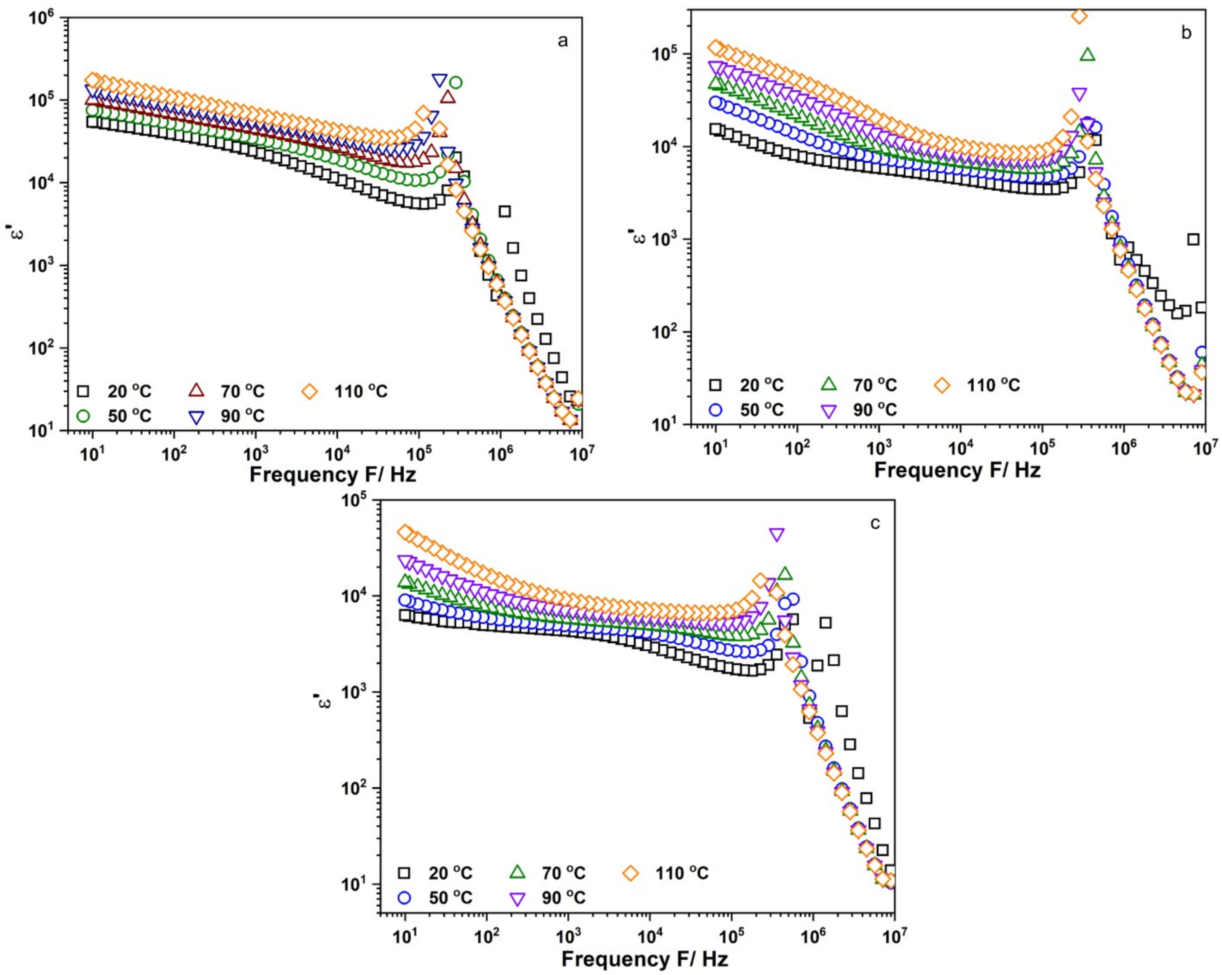

Figure S3: Frequency dependent of the real part of permittivity, ε', of (a) $Li_{5.96}Ca_{0.002}\ PS_5Cl$; (b) $Li_{5.9}Ca_{0.05}\ PS_5Cl$ and (c) $Li_{5.8}Ca_{0.1}\ PS_5Cl$ measured from 10 Hz to 9 MHz.

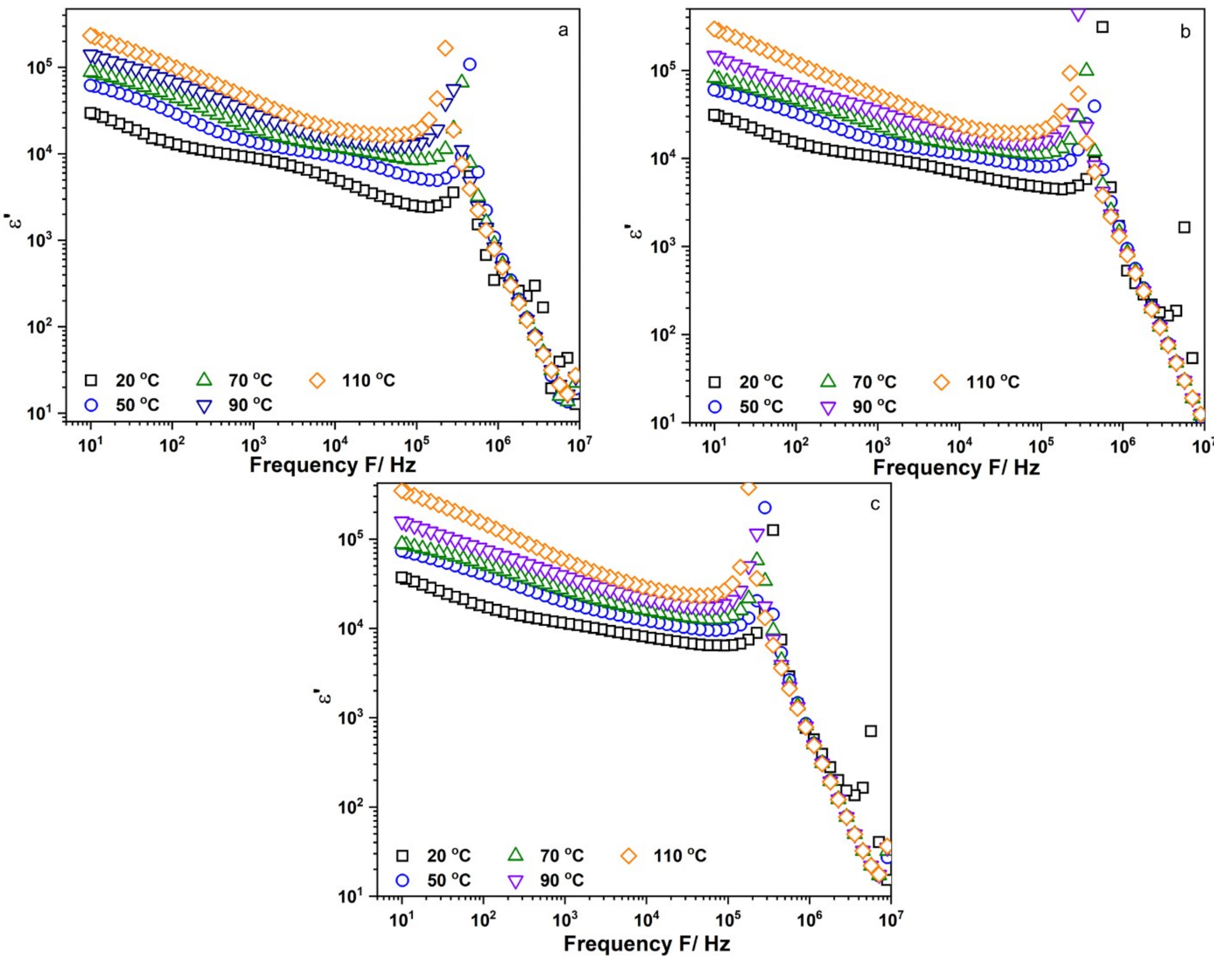

Figure S4: Frequency dependent of the real part of permittivity, ε', of (a) $Li_{5.94}Ba_{0.03}$ PS_5Cl; (b) $Li_{5.94}Zn_{0.03}$ PS_5Cl and (c) $Li_{5.94}Y_{0.02}$ PS_5Cl measured from 10 Hz to 9 MHz.

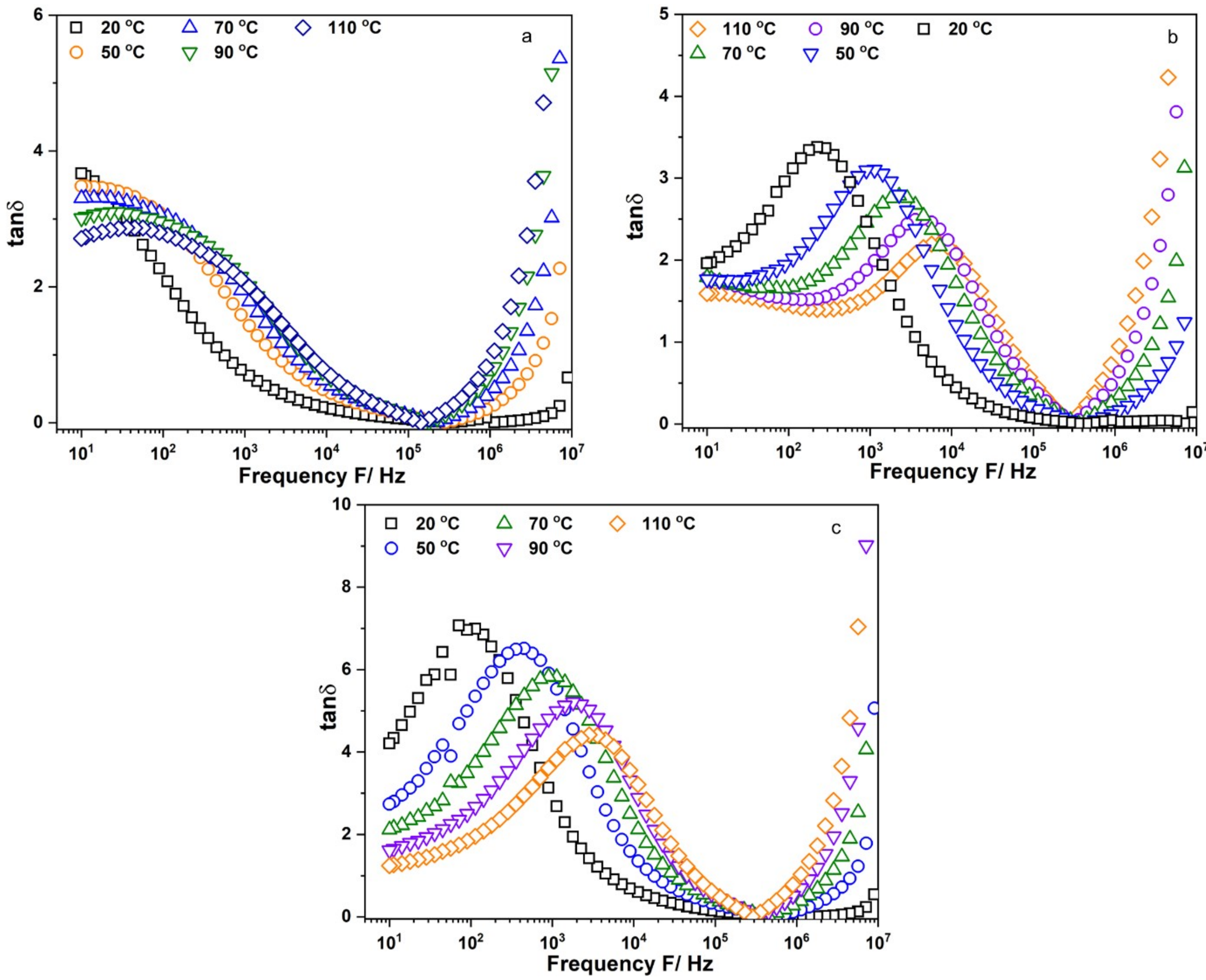

Figure S5: Frequency dependent of the loss factor, tanδ, of (a) $Li_{5.96}Ca_{0.002}$ PS_5Cl; (b) $Li_{5.9}Ca_{0.05}$ PS_5Cl and (c) $Li_{5.8}Ca_{0.1}$ PS_5Cl measured from 10 Hz to 9 MHz.

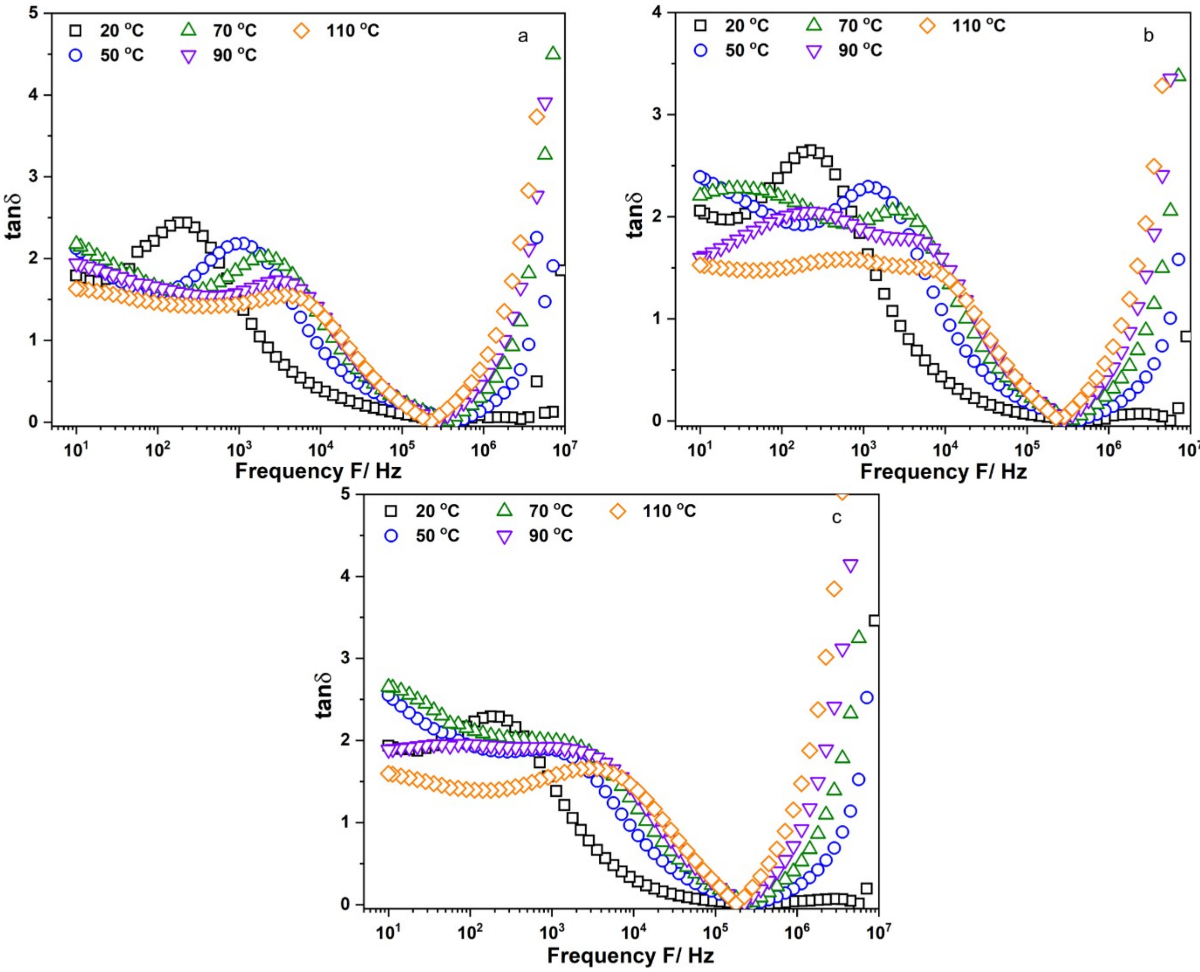

Figure S6: Frequency dependent of the loss factor, tanδ, of (a) $Li_{5.94}Ba_{0.03}$ PS_5Cl; (b) $Li_{5.94}Zn_{0.03}$ PS_5Cl and (c) $Li_{5.94}Y_{0.02}$ PS_5Cl measured from 10 Hz to 9 MHz.