Table 1 Mechanical properties of the rubbing surfaces

	Young Modulus	Poisson Ratio
Steel	220 GPa	0.3
Glass	70 GPa	0.2

Table 2 Parameters used to predict the lubricant film thickness based on Hamrock-Dowson formula

Parameters	**Value**		
	RT	60℃	80℃
Coefficient B	2.69		
Dynamic viscosity η_0	Listed in table 1		
Reduced Young's Modulus E'	1.17×10^{11} N/m^2		
Contact radius R_x	9.5 mm		
Entrainment speed U for film thickness tests	0.1 ~ 2.5 m/s	1 ~ 3 m/s	2 ~ 3 m/s
Load	15 N and 20 N		
Applied Hertzian Average Pressure	0.31 GPa and 0.41 GPa		

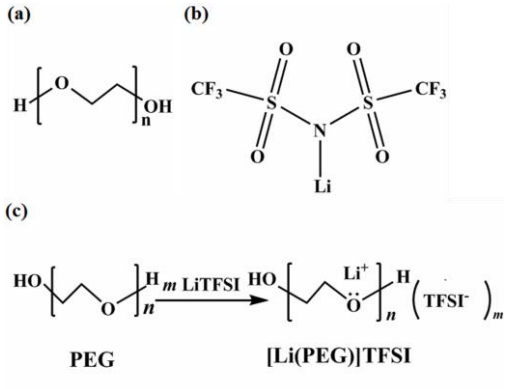


Fig.1 Molecular structures of (a) PEG, (b) LiTFSI and (c) *in situ* synthetic process of ILs

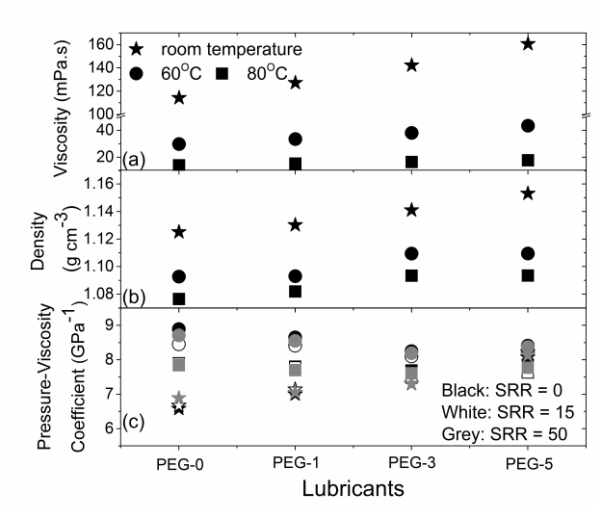


Fig.2 The effect of IL concentration on (a) viscosity; (b) density and (C) pressure-viscosity coefficients of PEG based lubricants

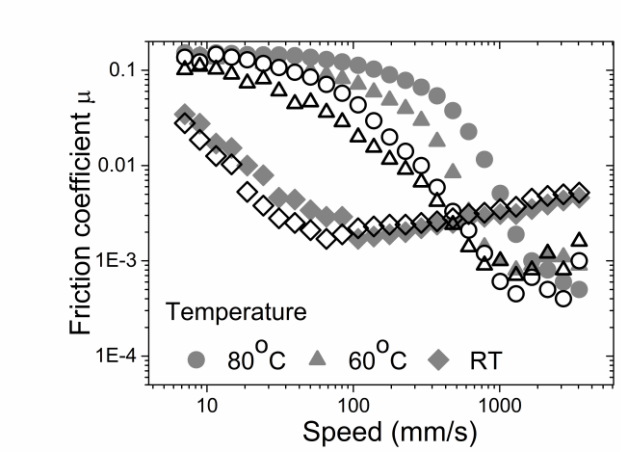


Fig.3 The effect of temperature on Stribeck curves for PEG-0 (neat PEG, solid symbols) and PEG-3 (PEG with 3 wt.% IL additives, open symbols) at an applied load of 15 N and SRR = 5%

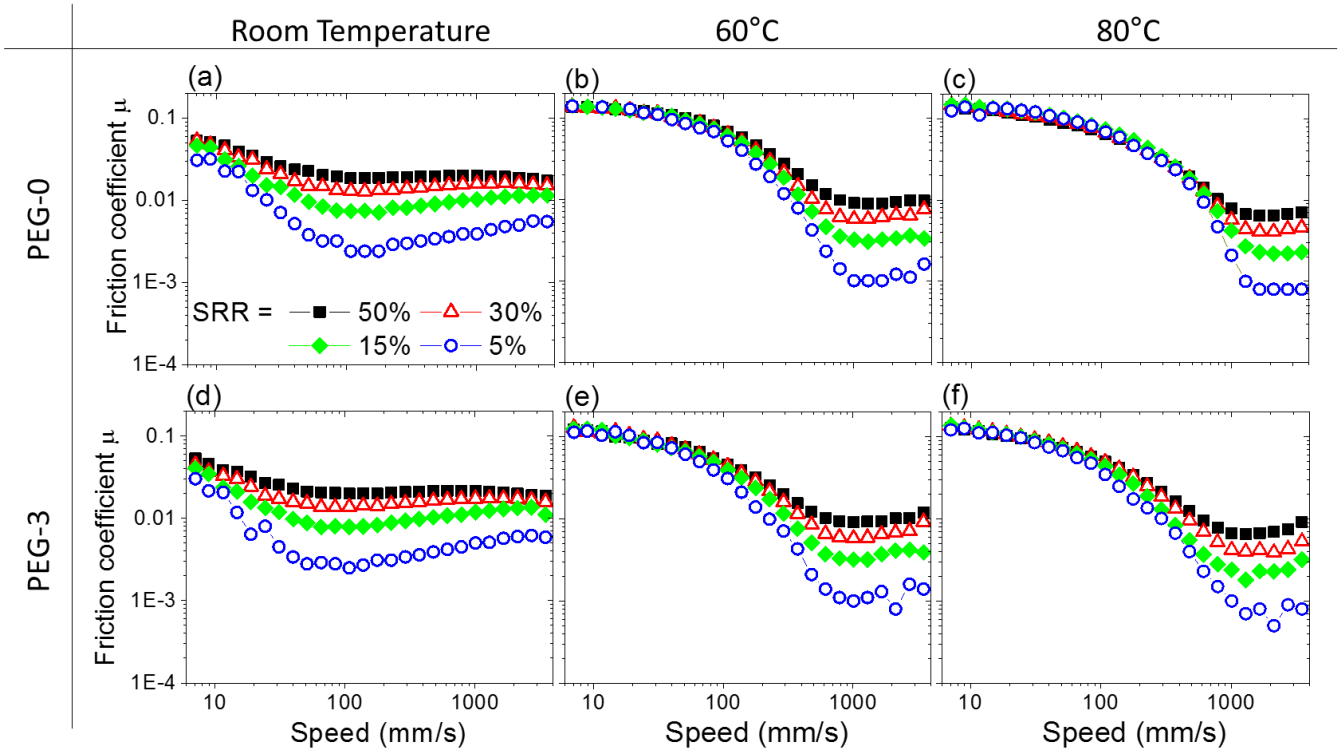


Fig.4 The effect of temperature on Stribeck curves for PEG-0 and PEG-3.

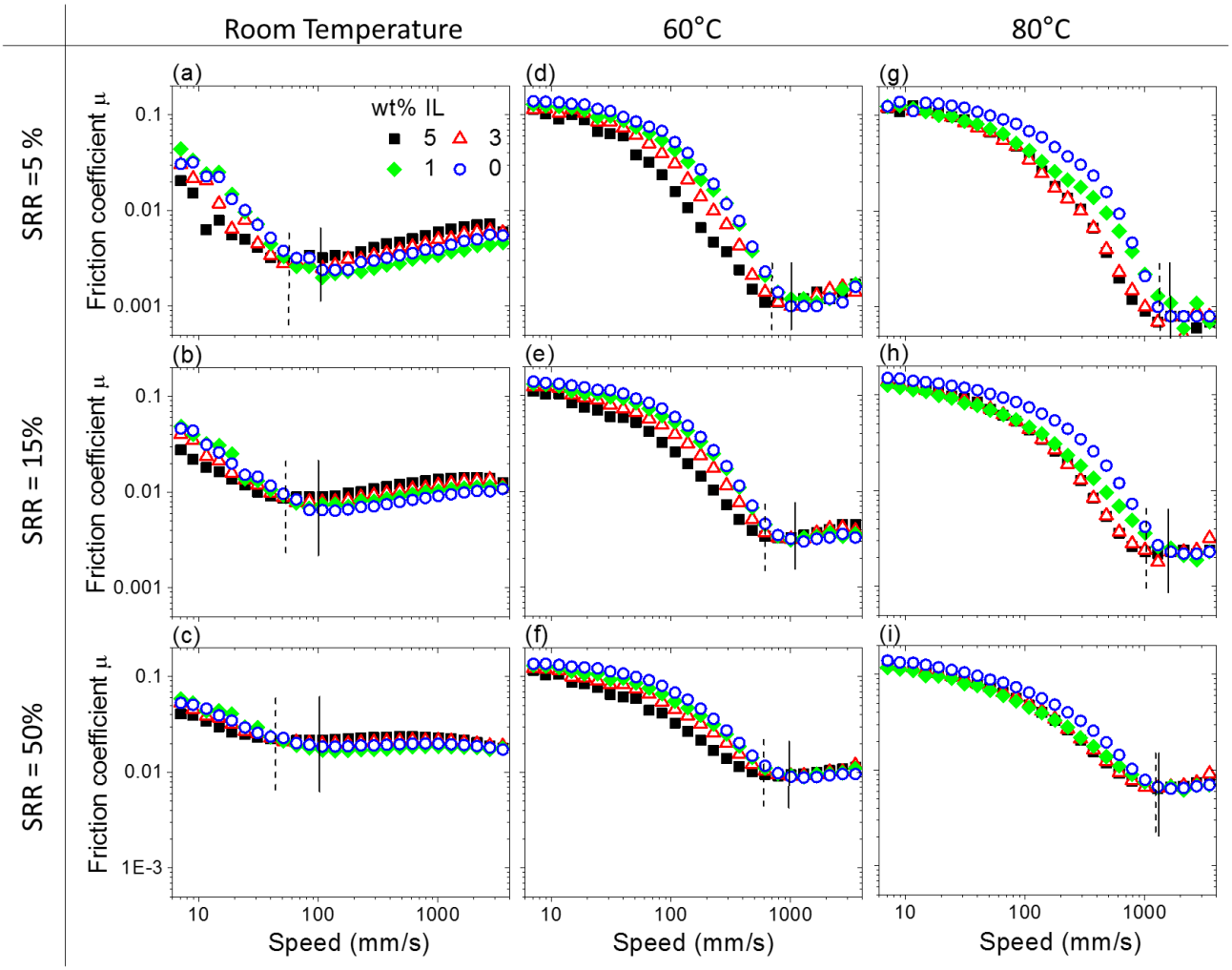


Fig. 5 The effect of IL additives concentration on Stribeck curve of PEG and PEG with IL additives. The solid and dash vertical lines approximate U_{EHL} for PEG-0 and PEG-5 respectively.

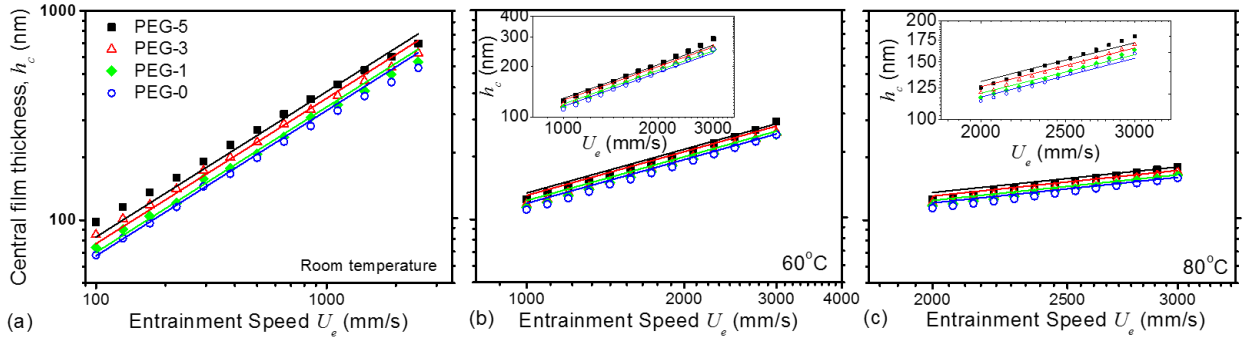


Fig. 6 Comparisons between measured (symbols) and predicted (lines) film thickness at an applied load of 20 N and SRR =0. Predictions is performed using pressure-viscosity coefficient (α) of PEG-0.

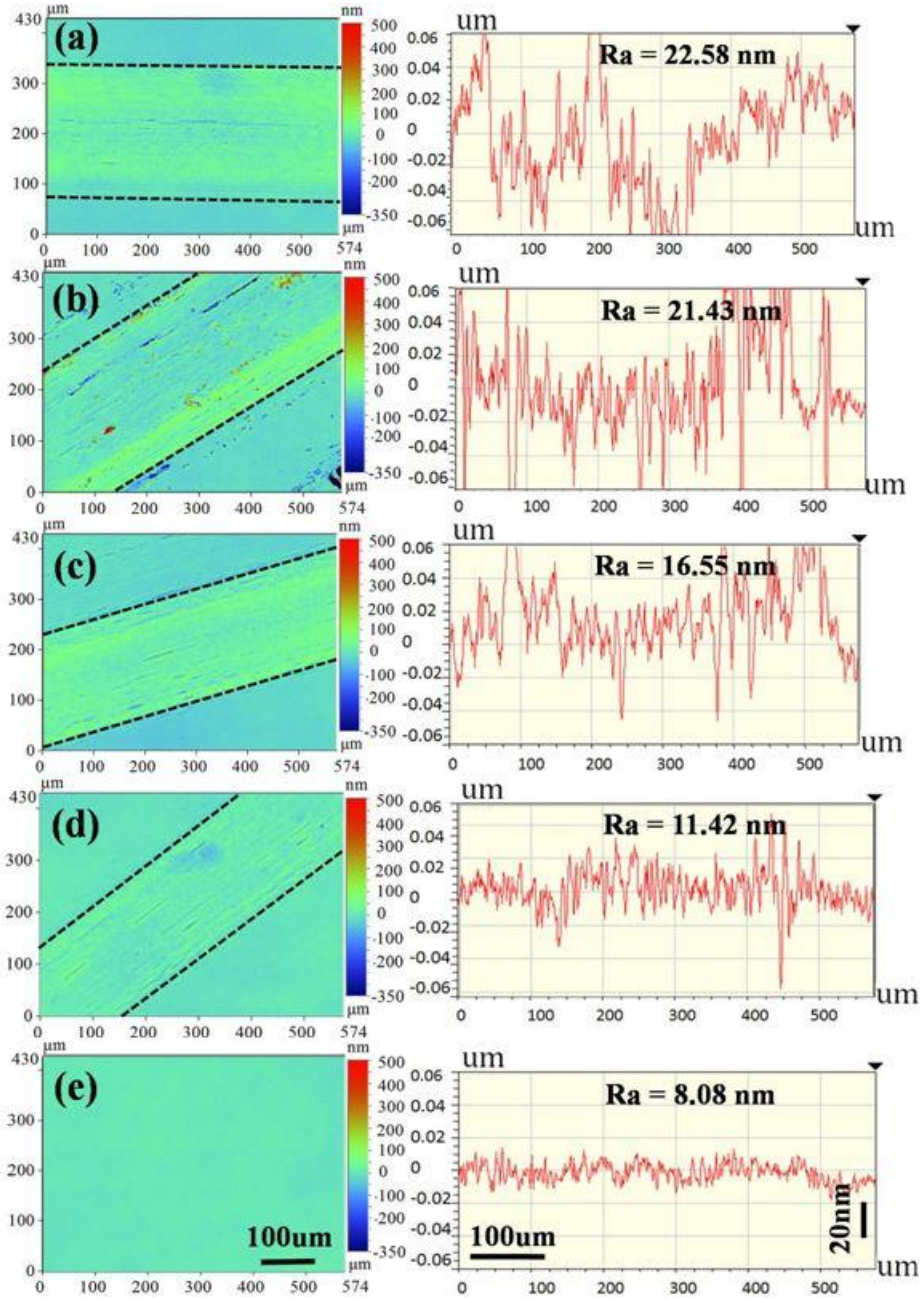


Figure 7 2-D images and cross-section profiles of wear track for (a) PEG-0, (b) PEG-1, (c) PEG-3, and (d) PEG-5. The dash lines highlight the locations of the wear tracks on the discs and are for guidance only. (e) 2-D image and cross-section of a pristine steel disc.