

# Tribological Properties of Borate-Based Protic Ionic Liquids as Neat Lubricants and Biolubricant Additives for Steel-Steel Contact

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**Table S1.** Elemental composition (wt. %) of 316 stainless steel disks.

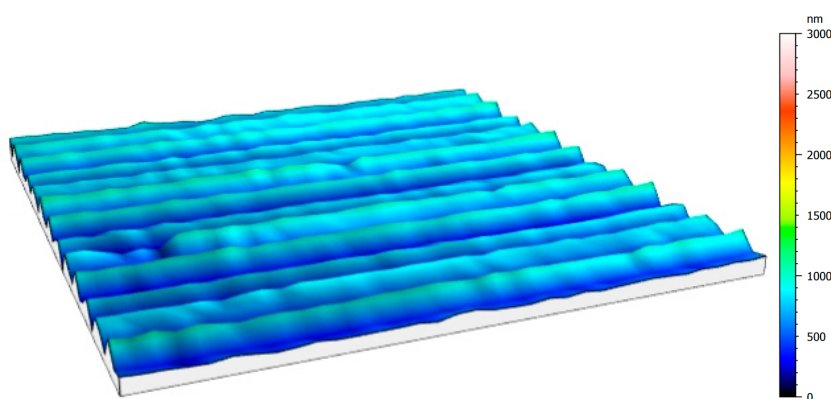
Element	Fe	Cr	Ni	Mo	Si	P	S
Content (%)	64.93–71.50	16.50–18.50	10.00–13.00	2.00–2.50	0.0–1.0	0.0–0.05	0.0–0.02

**Table S2.** Elemental composition (wt. %) of AISI 52100 steel balls.

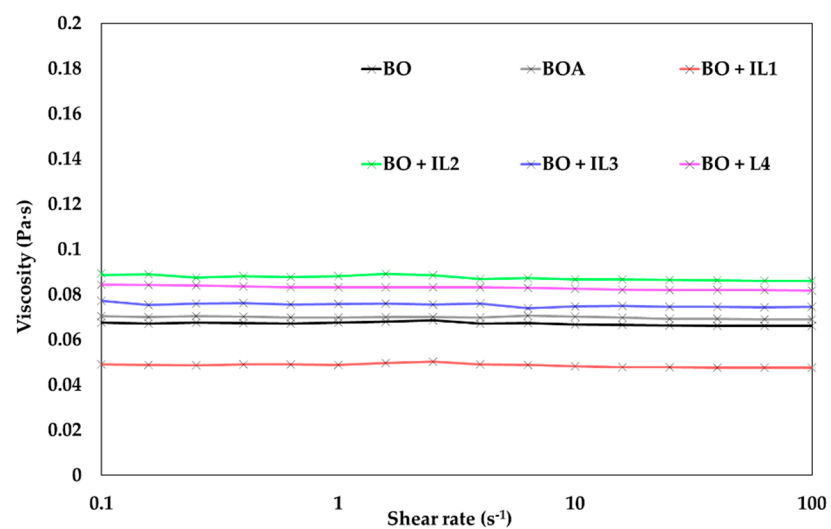
Element	Fe	Cr	C	Mn	Si	S	P
Content (%)	96.50–97.32	1.30–1.60	0.98–1.10	0.25–0.45	0.15–0.30	0.025	0.025

**Table S3.** Mechanical polishing steps for the 316 stainless steel disks.

Step	Type	Speed	Force	Lubricant	Time
Grinding	SiC #220	300 rpm	15N	Water	3 min
Grinding	SiC #500	300 rpm	15N	Water	3 min
Grinding	SiC #1200	300 rpm	15N	Water	3 min
Polishing	Woven polyester	150 rpm	15N	Diamond suspension, 9 $\mu$ m	3 min
Polishing	Synthetic nap	150 rpm	15N	Diamond suspension, 3 $\mu$ m	5 min



**Figure S1.** 3D Profile of a polished disk.



**Figure S2.** Variation of viscosity with shear rate for BO, BOA, BO + IL1, BO + IL2, BO + IL3, and BO + IL4.