Study of run-in and self-healing of cylinder based on nano lubricants

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北京交通大學
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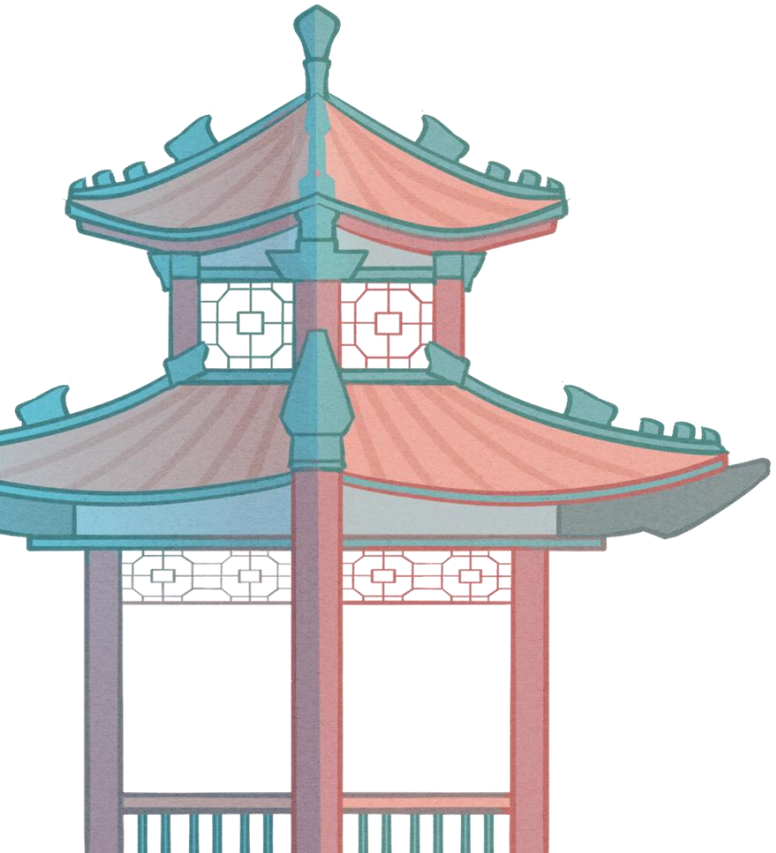
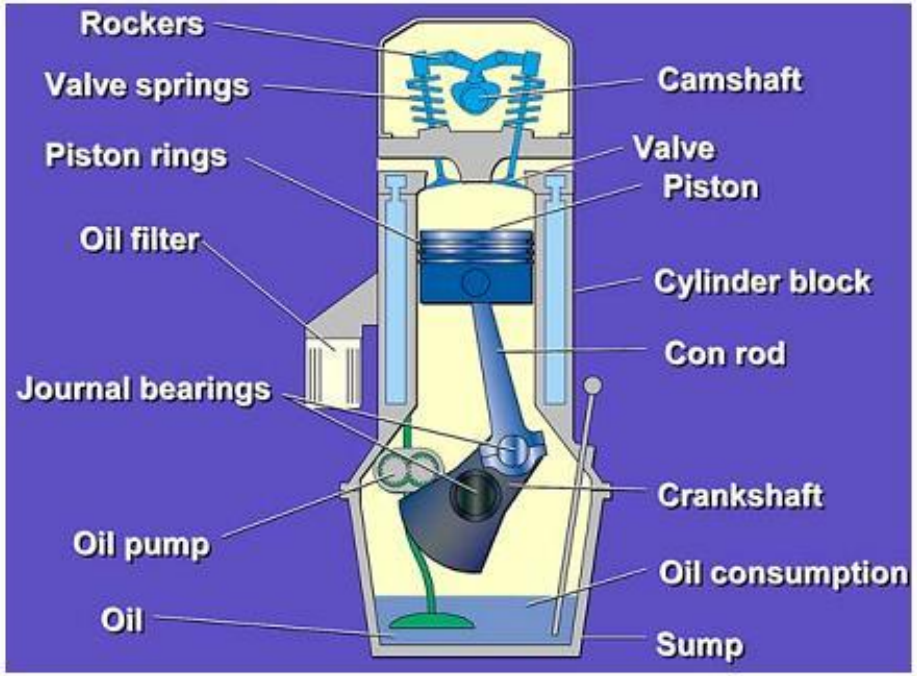
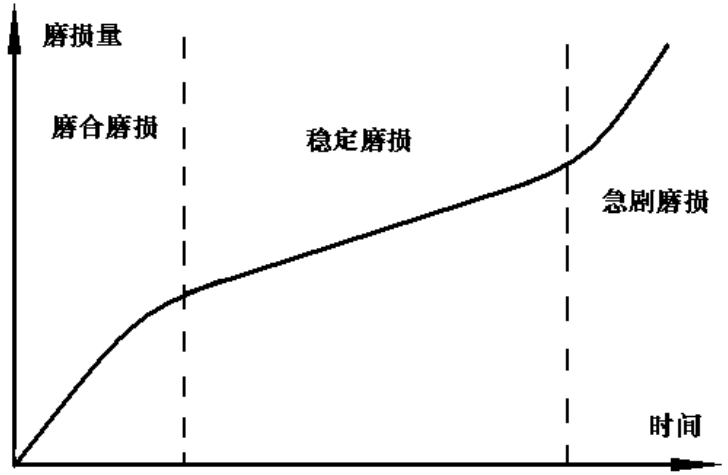


1 Background

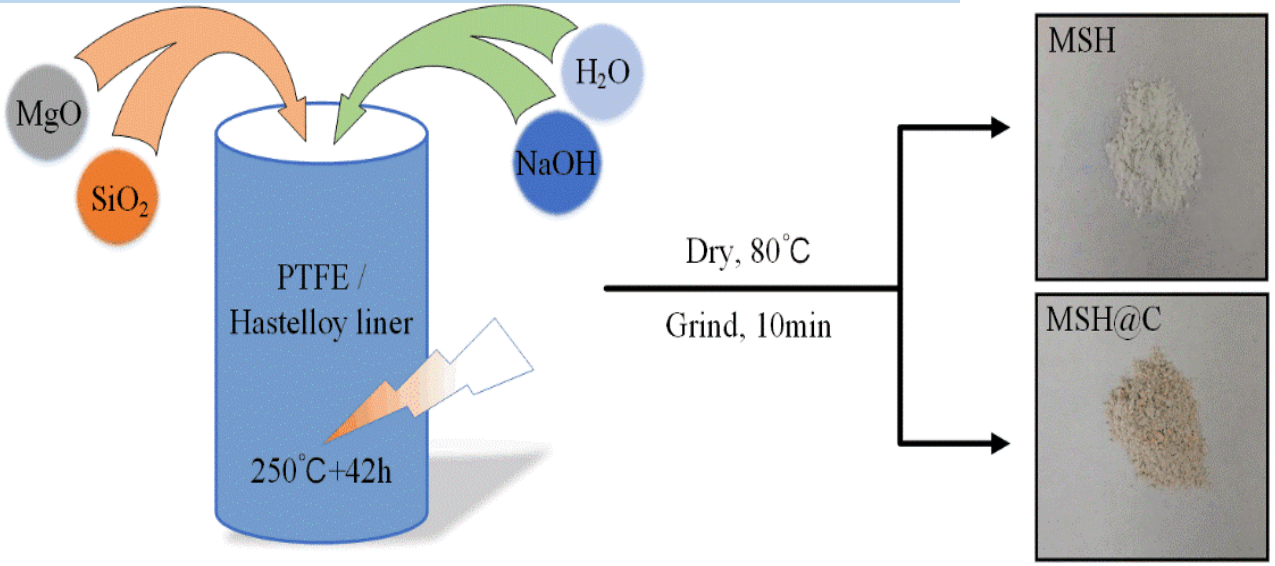


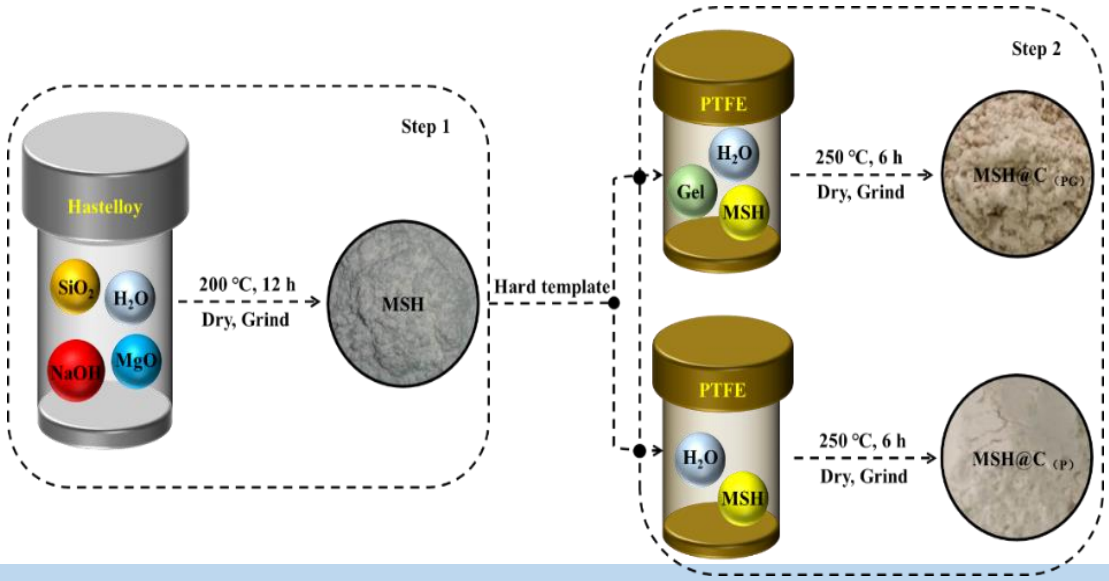


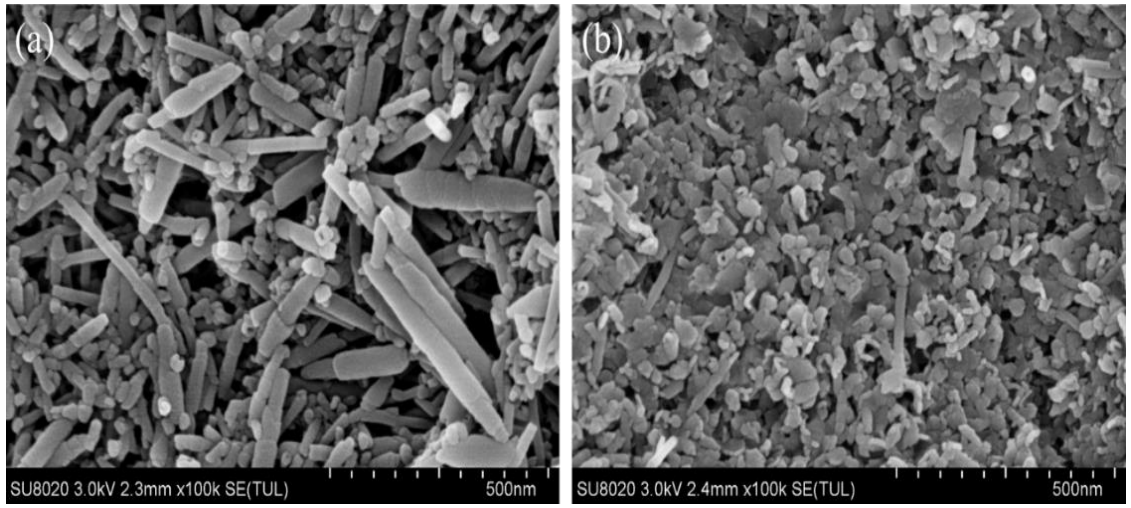
Shorten run-in period,
Increase run-in quality

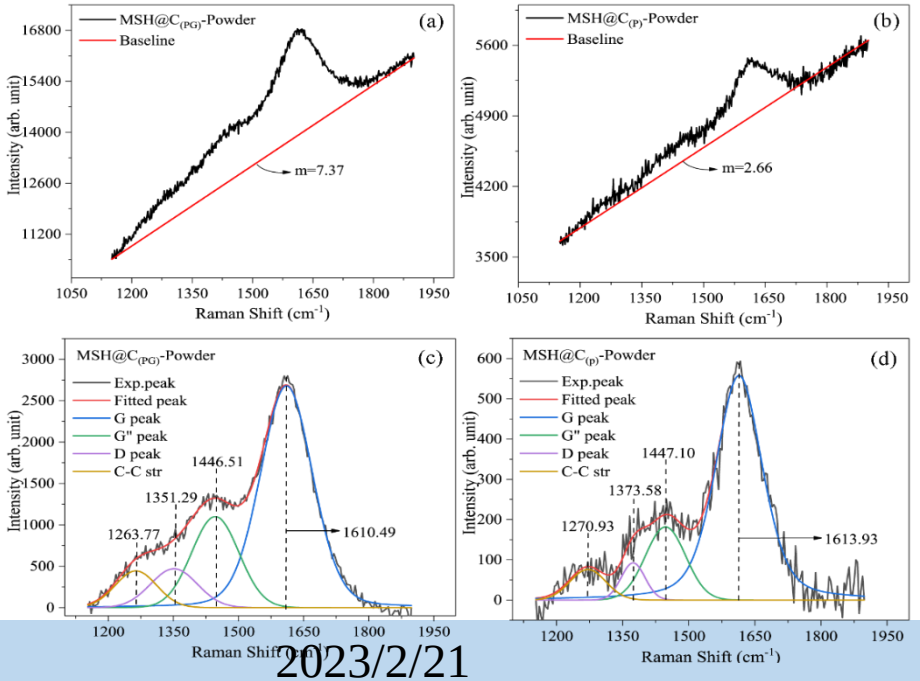
Self-healing

2 Preparation of Nano MSH



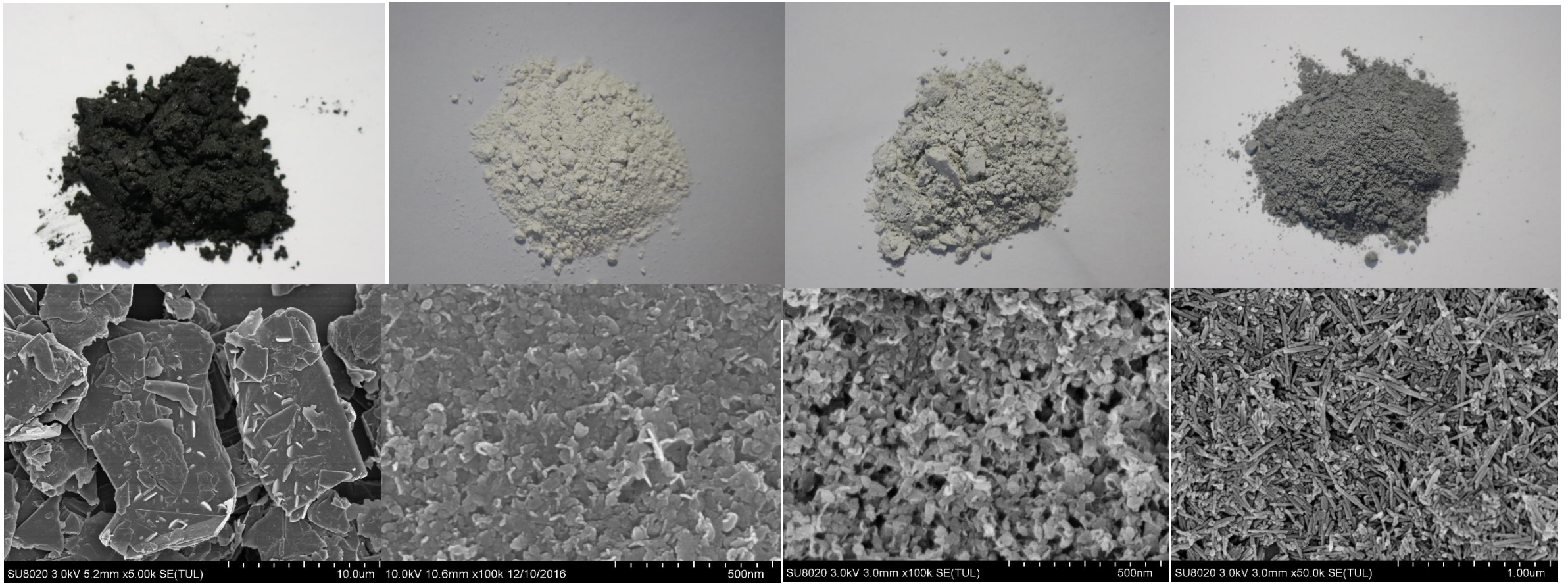




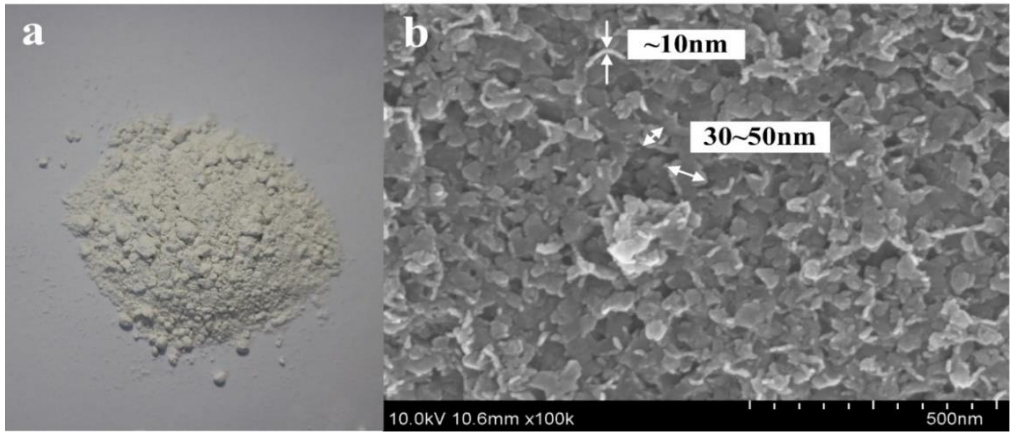


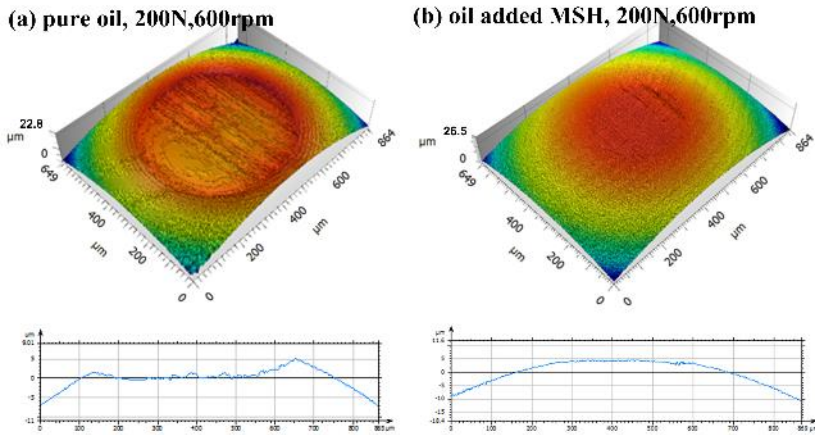
2 Preparation of Nano MSH

石墨　　片状纯MSH　　片状石墨烯包覆MSH/C　　管状石墨烯包覆MSH/C

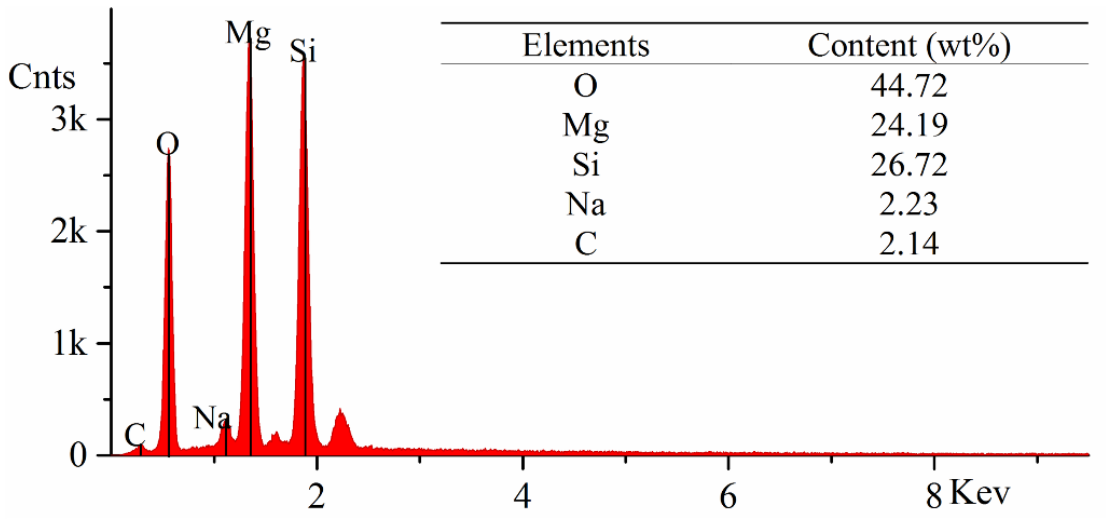


2 Preparation of Nano MSH

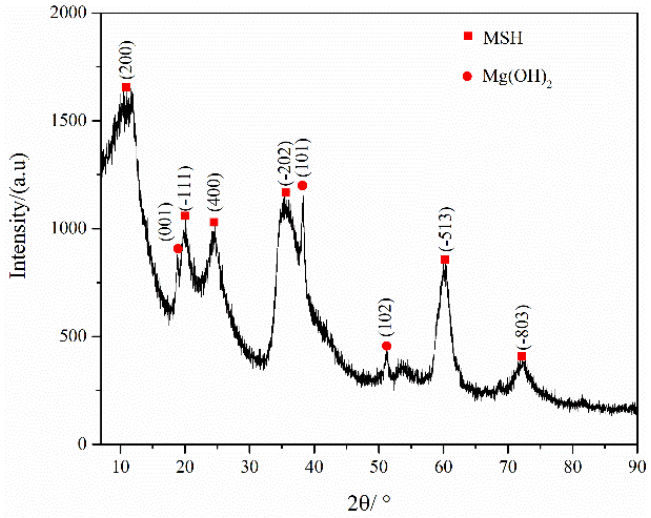


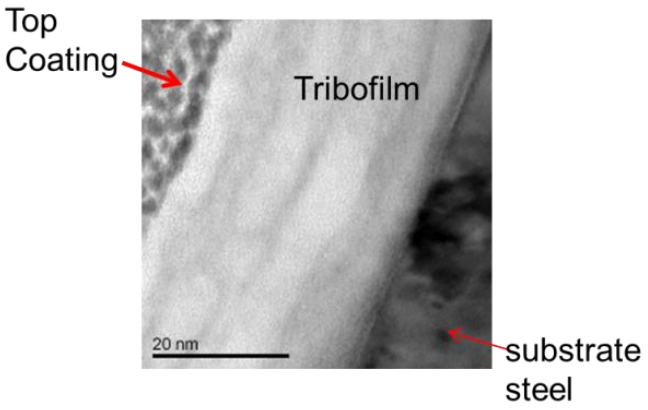


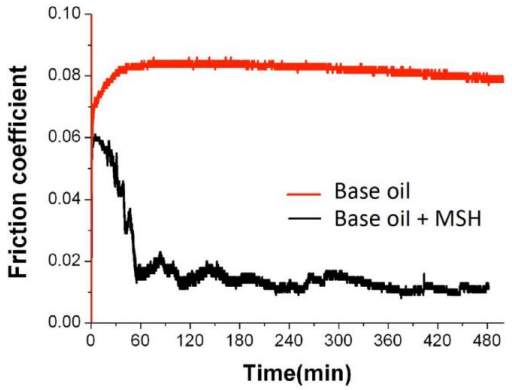
2 Preparation of Nano MSH

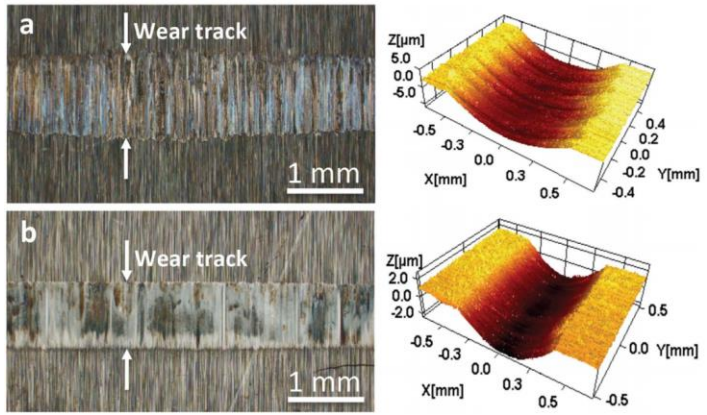


Elements	Content (wt%)
O	44.72
Mg	24.19
Si	26.72
Na	2.23
C	2.14









Test rig

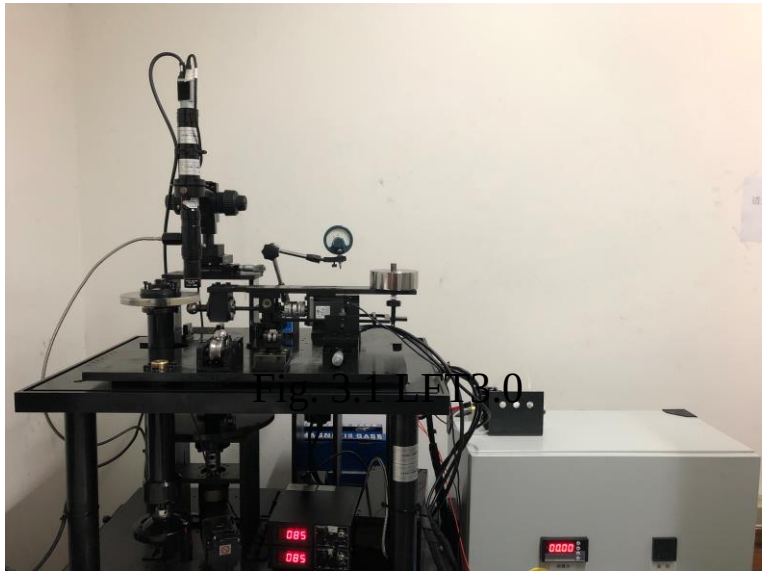
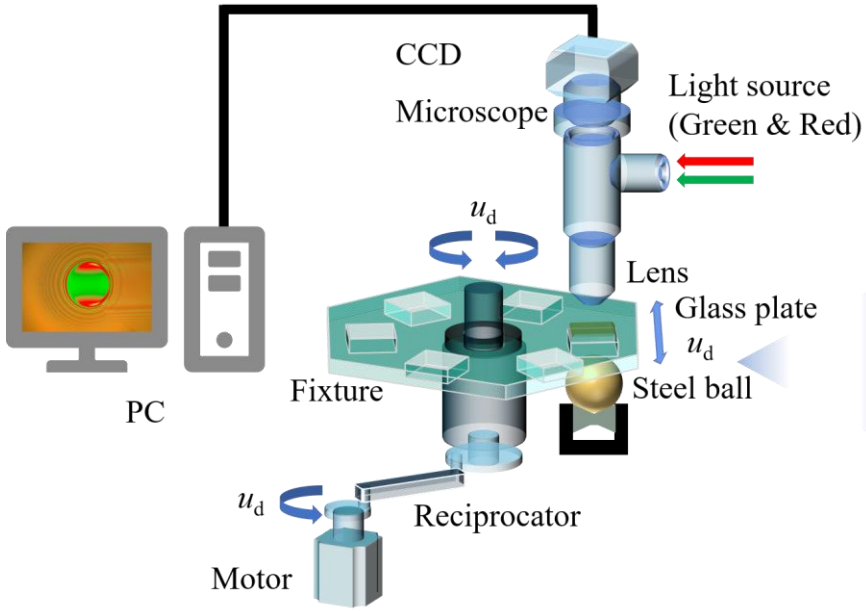
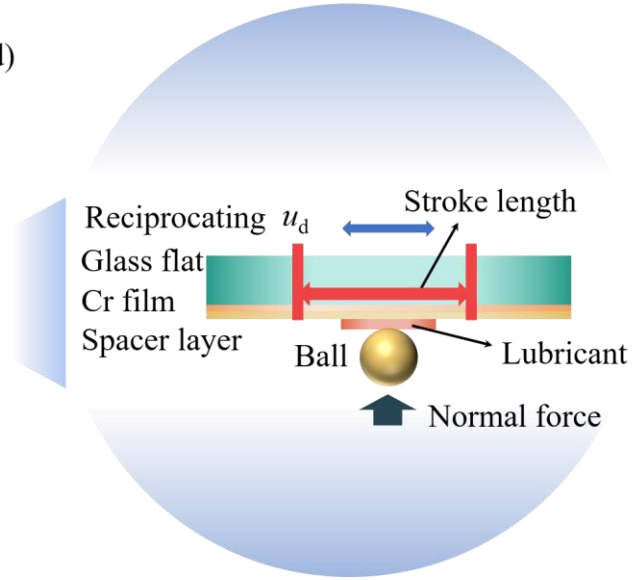


Fig. 3.1 LFT 3.0



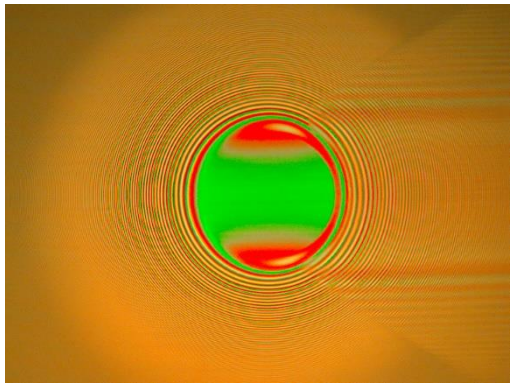


3 Film forming property of different particles

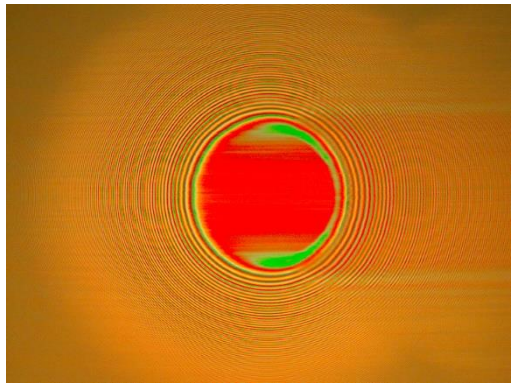
Table. 2.1 Test conditions used in this study

Test conditions	
Entrainment speed /u_e (mm/s)	200
Load /w(N)	60 N
Slide-roll ratio /*SRR*	0~1
Lubricant supply	Fully flooded
Lubricant	PAO10
	PAO10+0.5wt%MSH
	PAO10+0.5wt%MSH@C
	PAO10+0.5wt%MSH+0.5wt%OA
	PAO10+0.5wt%Tribotex
	PAO10+8wt%Tribotex
	PAO10+0.5wt%PTFE

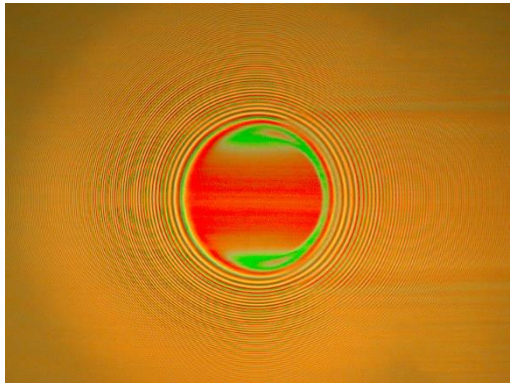
3 Film forming property of different particles



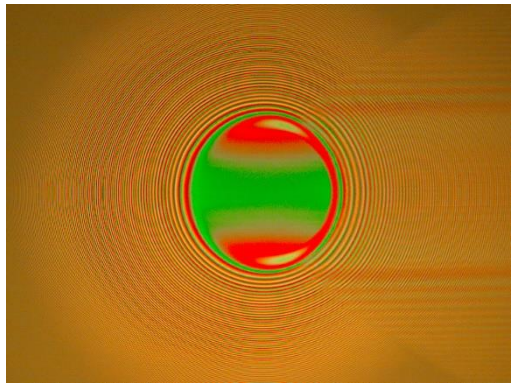
PAO10



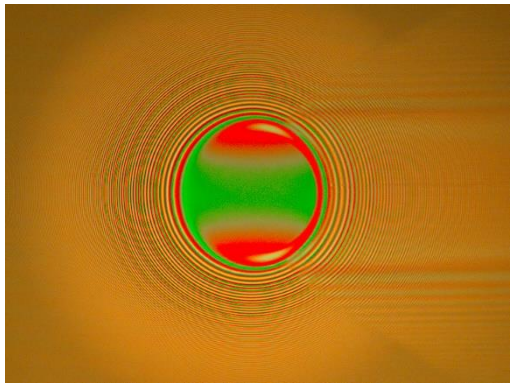
PAO10+0.5wt%MSH



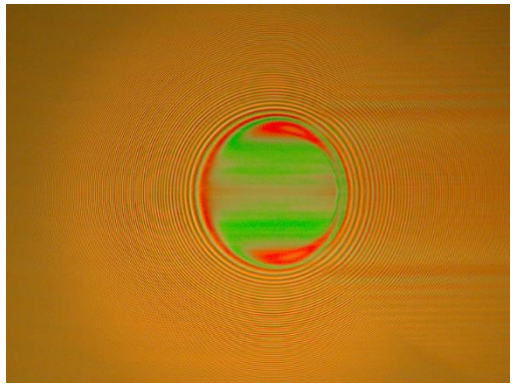
PAO10+0.5wt%MSH@C



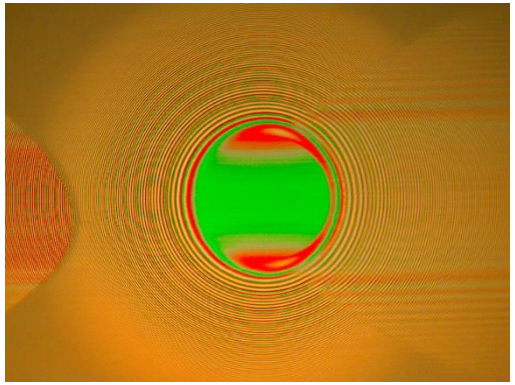
PAO10+0.5wt%MSH +0.5wt%OA



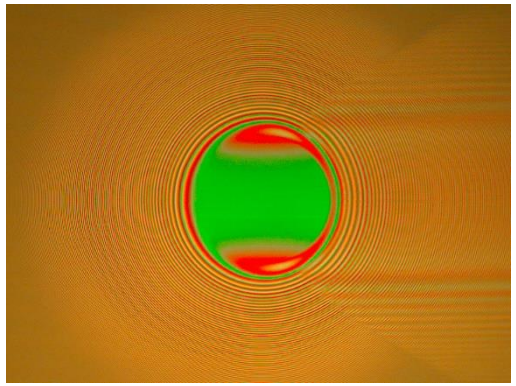
PAO10+0.5wt%Tribotex



PAO10+8wt%Tribotex



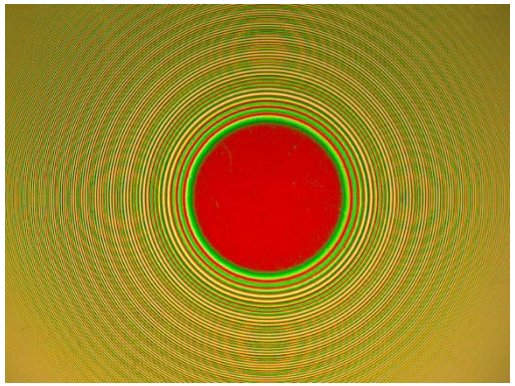
PAO10+0.5wt%Talcum



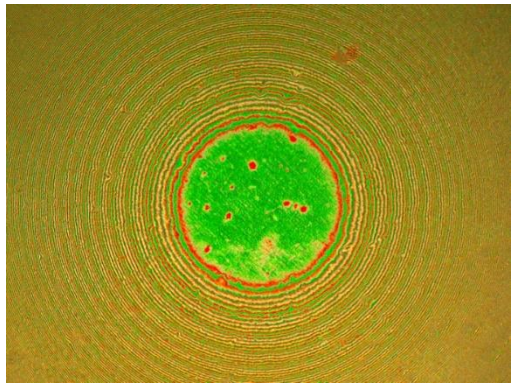
PAO10+0.5wt%PTFE

Fig. 3.3 Interference images, u_e= 200 mm/s, t =11 h

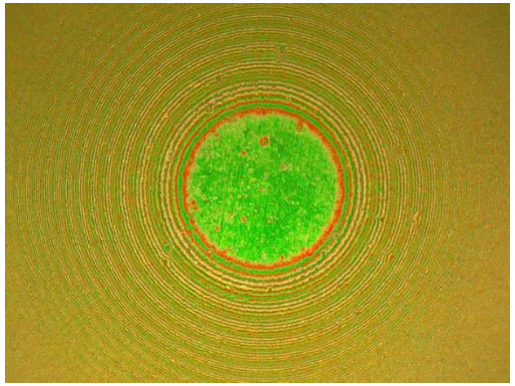
3 Film forming property of different particles



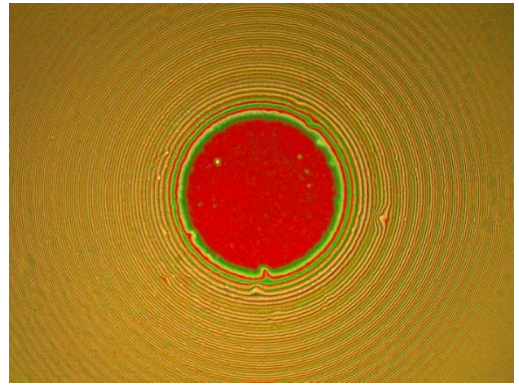
PAO10



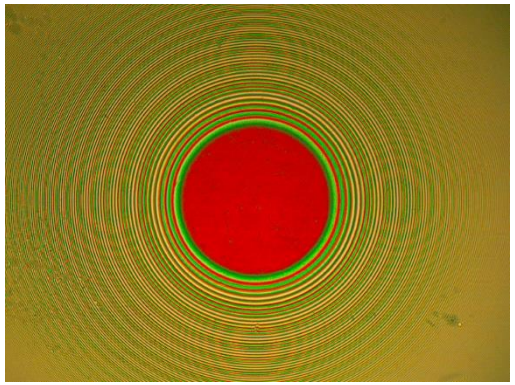
PAO10+0.5wt%MSH



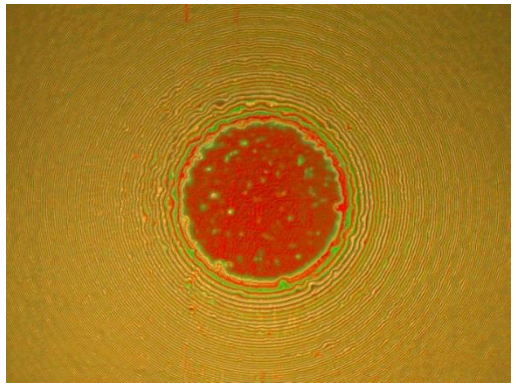
PAO10+0.5wt%MSH@C



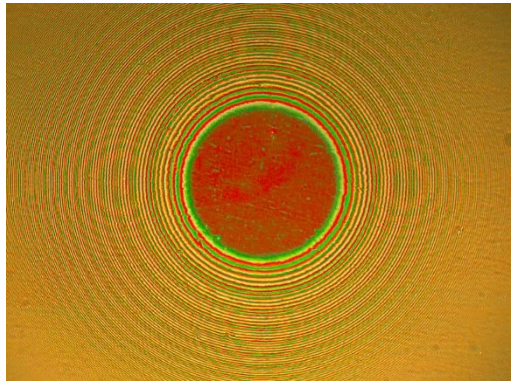
PAO10+0.5wt%MSH +0.5wt%OA



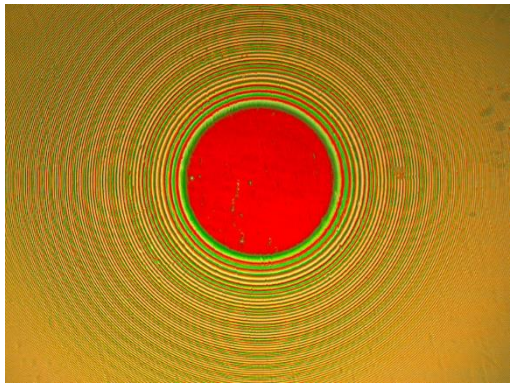
PAO10+0.5wt%Tribotex



PAO10+8wt%Tribotex



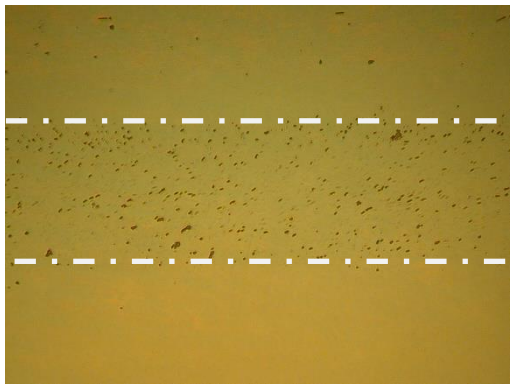
PAO10+0.5wt%Talcum Powder



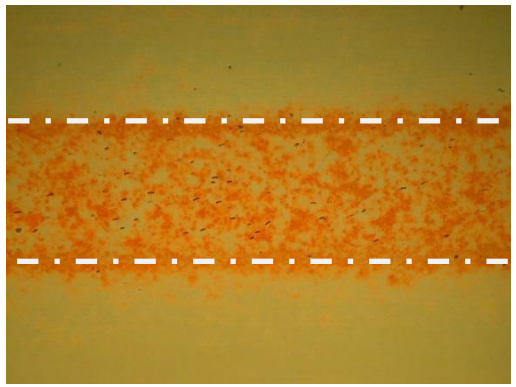
PAO10+0.5wt%PTFE

Fig. 3.4 Interference images after experiment

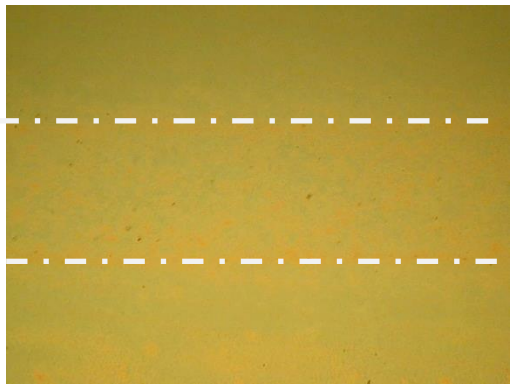
3 Film forming property of different particles



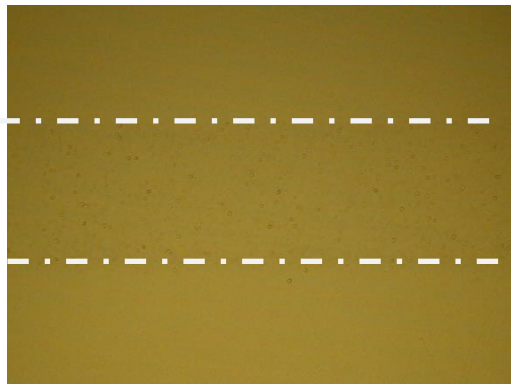
PAO10



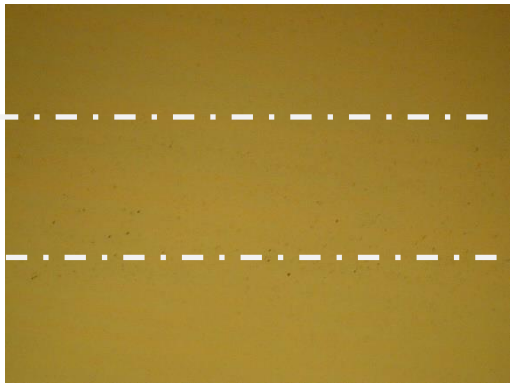
PAO10+0.5wt%MSH



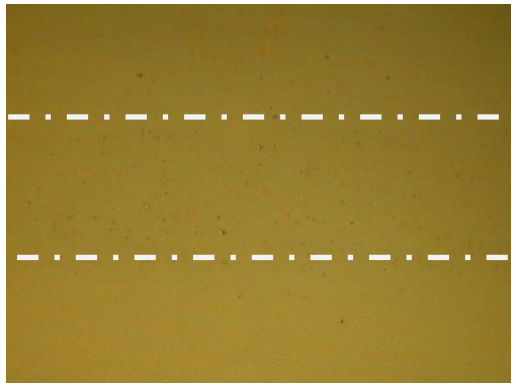
PAO10+0.5wt%MSH@C



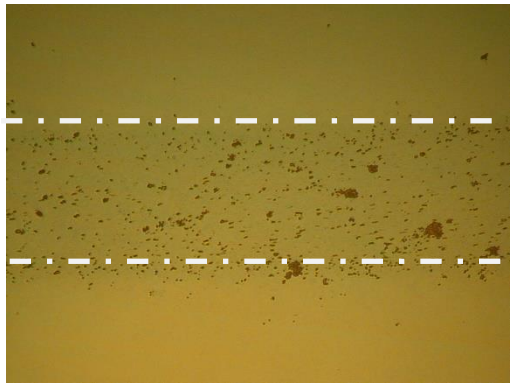
PAO10+0.5wt%MSH +0.5wt%OA



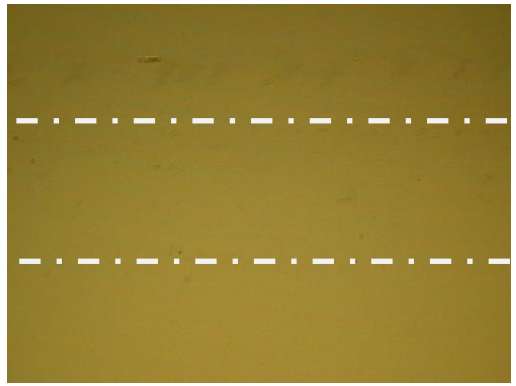
PAO10+0.5wt%Tribotex



PAO10+8wt%Tribotex



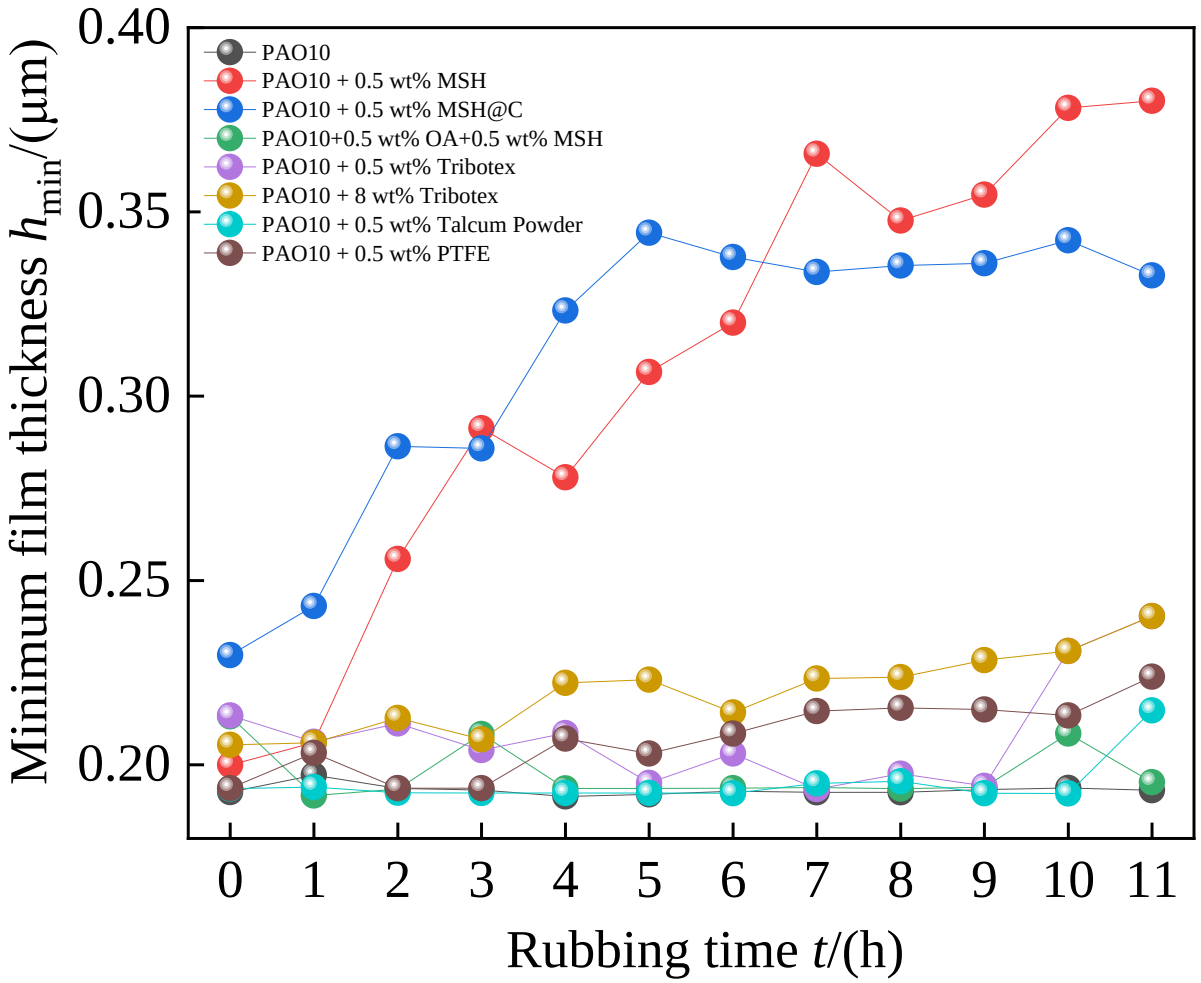
PAO10+0.5wt%Talcum



PAO10+0.5wt%PTFE

Fig. 3.5 Glass disc surface change

3 Film forming property of different particles



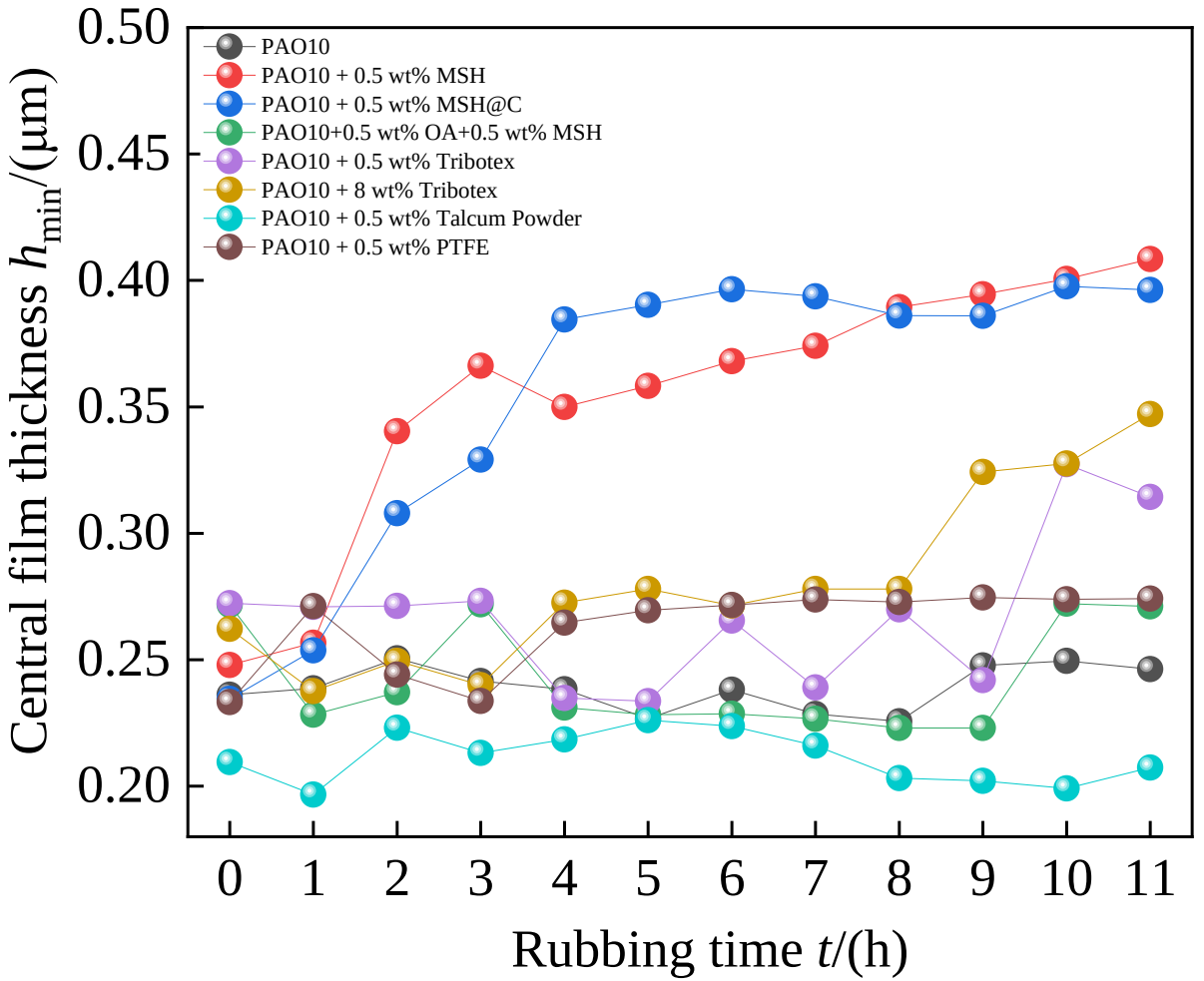
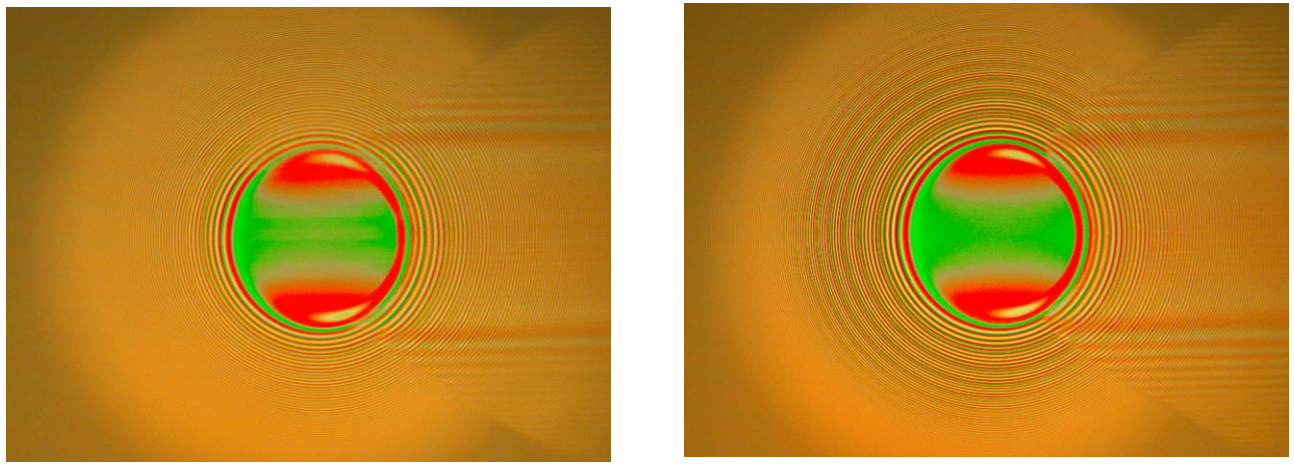


Fig. 3.7 Film thickness over test time, pure roll

4.1 Film forming property under rotating movement

Table 4.1 Test conditions used in pure roll study

Test conditions	
Entrainment speed /u_e (mm/s)	10-1000 mm/s
Load /w(N)	60 N
Lubricant	PAO10
	PAO10+ 0.5 wt%MSH
Lubricant supply	Fully flooded



PAO10+0.5wt%MSH　　PAO10

Fig. 4.1 Interference images change under pure roll condition over test time

4.1 Film forming property under rotating movement

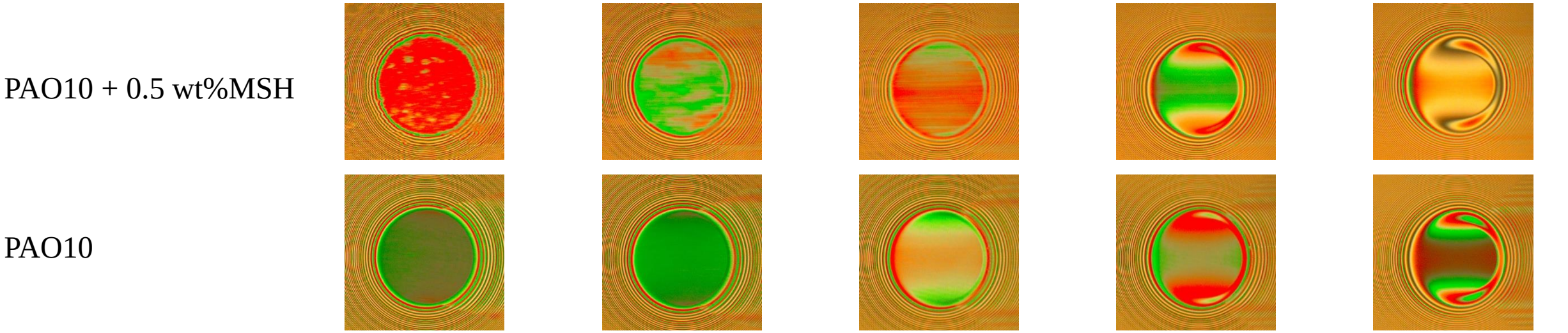
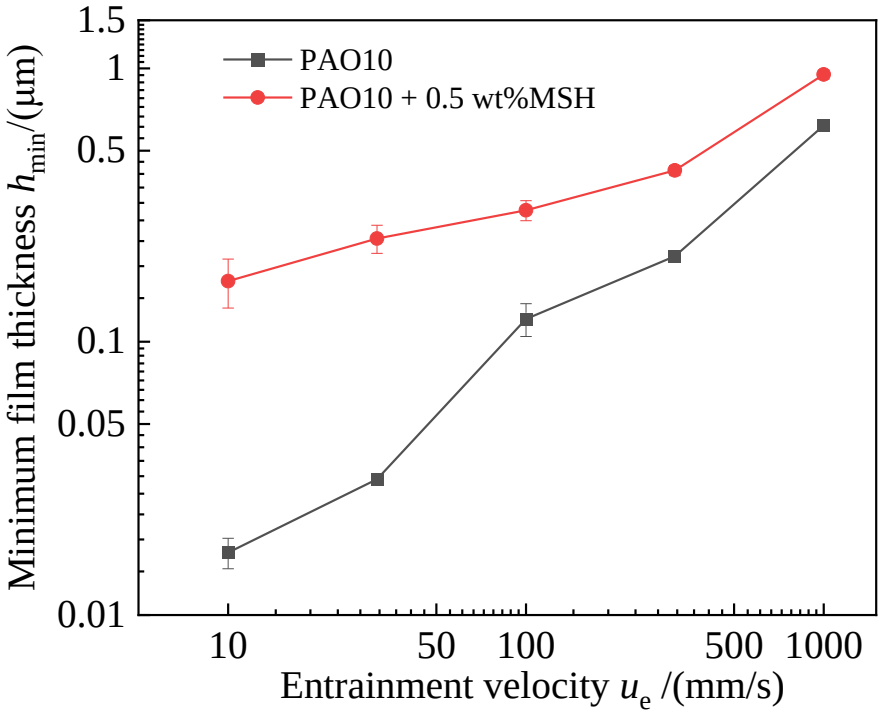


Fig. 4.2 Interference images under pure roll condition with different velocities

4.1 Film forming property under rotating movement



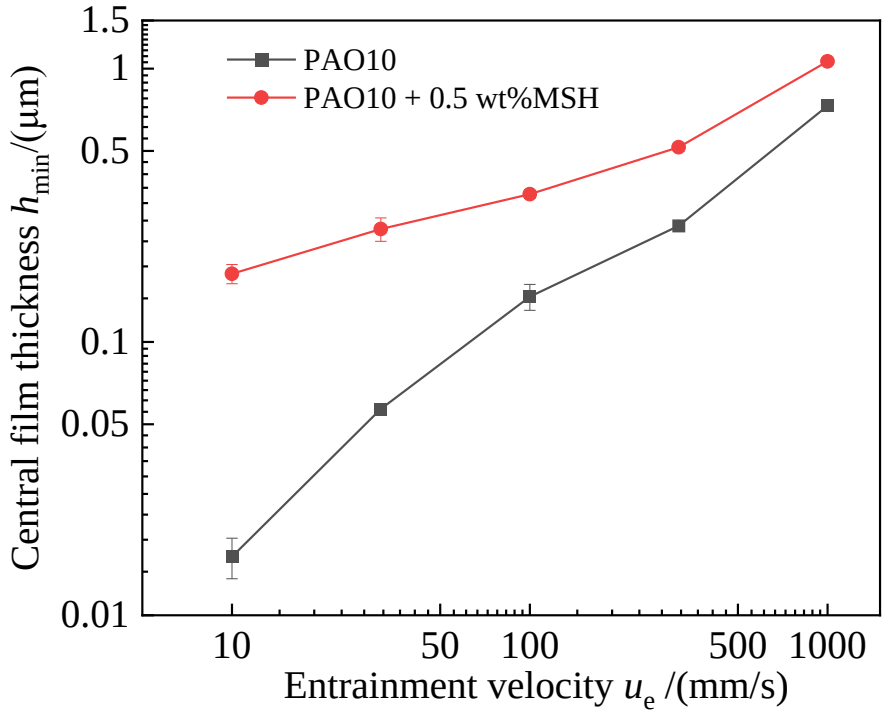
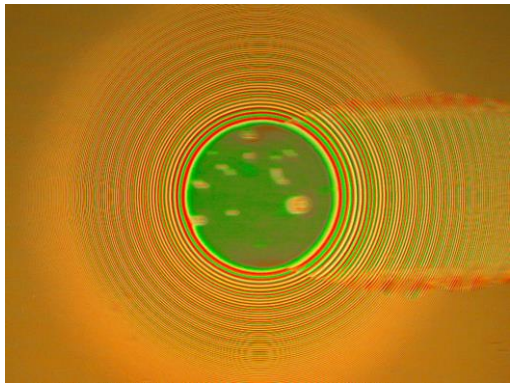
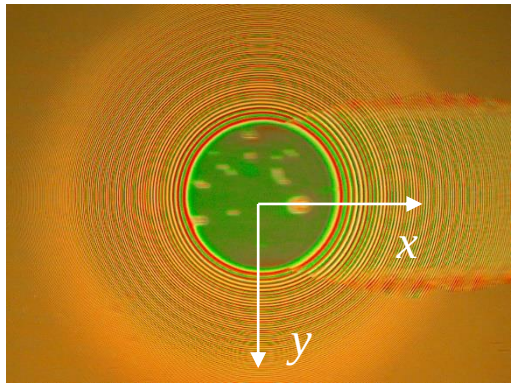


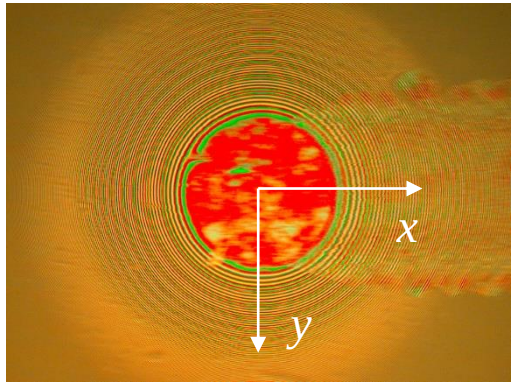
Fig. 4.3 Film thickness

4.1 Film forming property under rotating movement

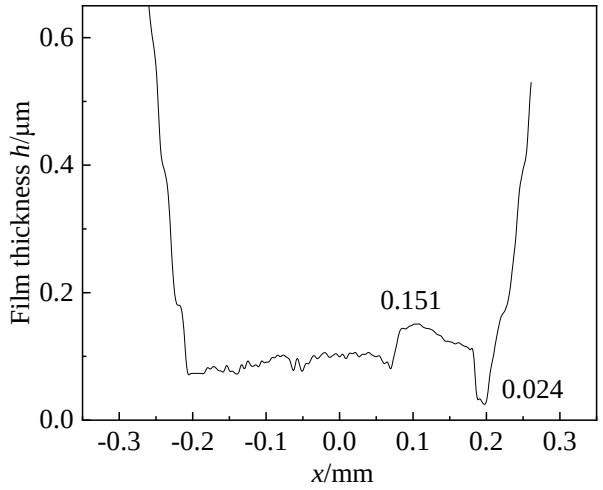


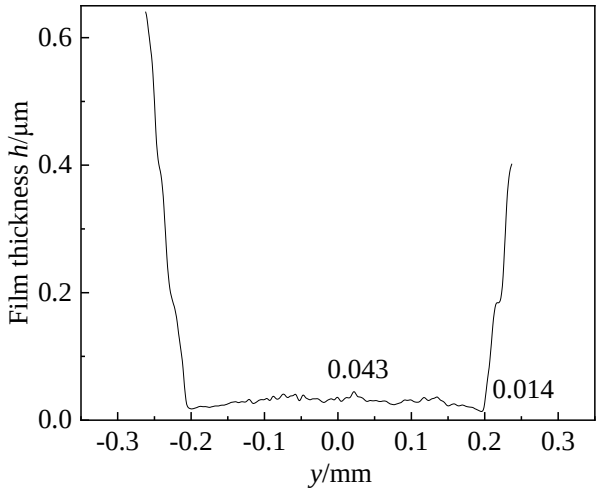


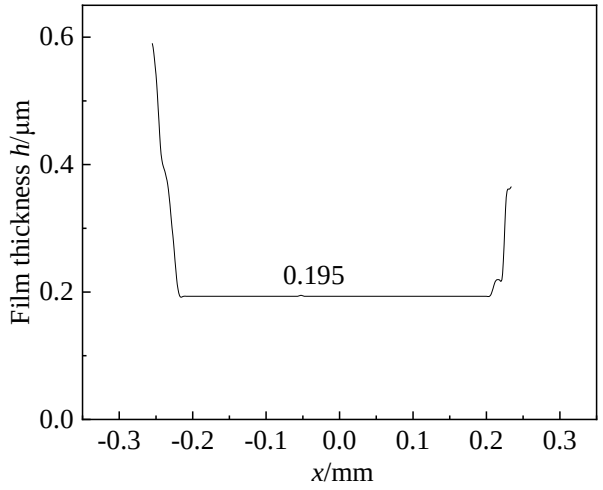
Initial



After 7 h







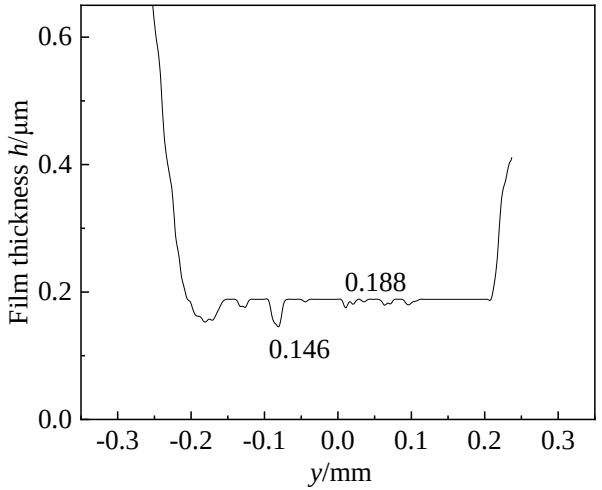
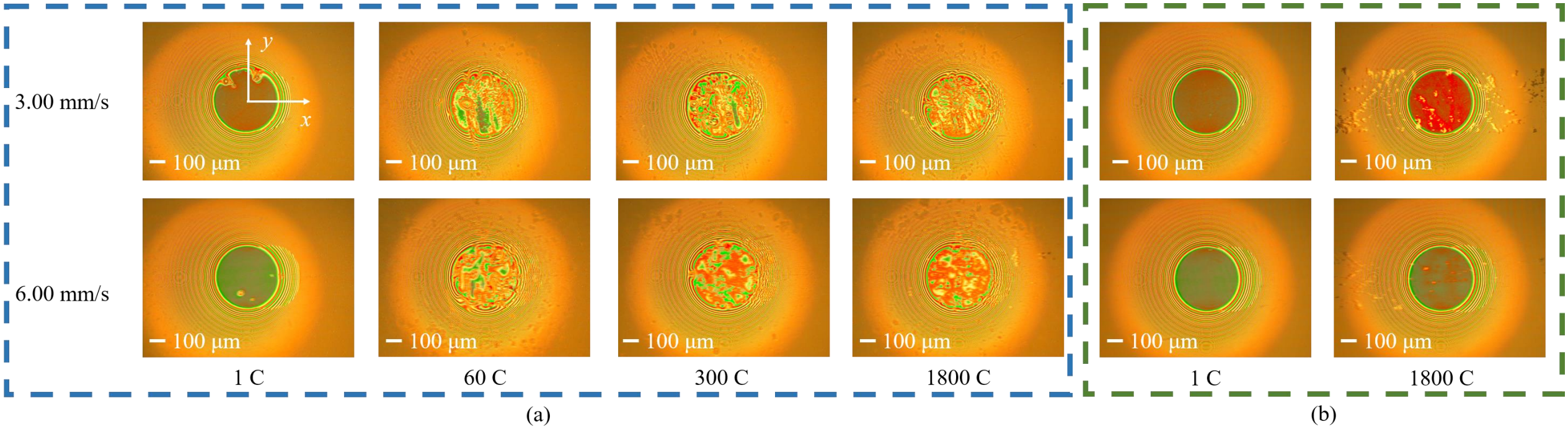
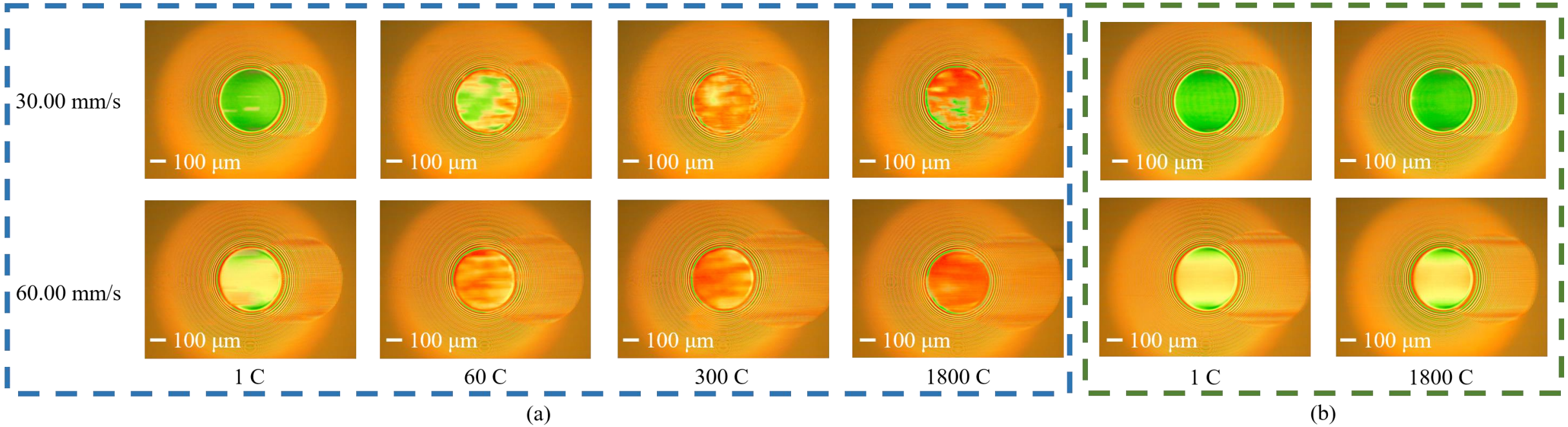


Fig. 4.4 Film thickness growth under mixed lubrication

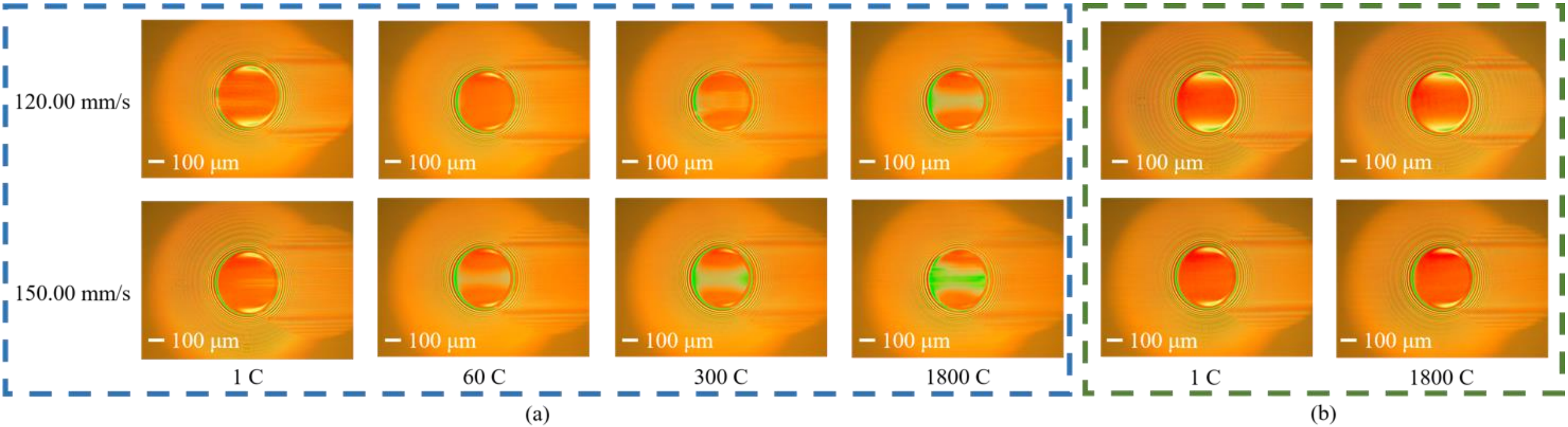
4.2 Film forming property under reciprocating movement



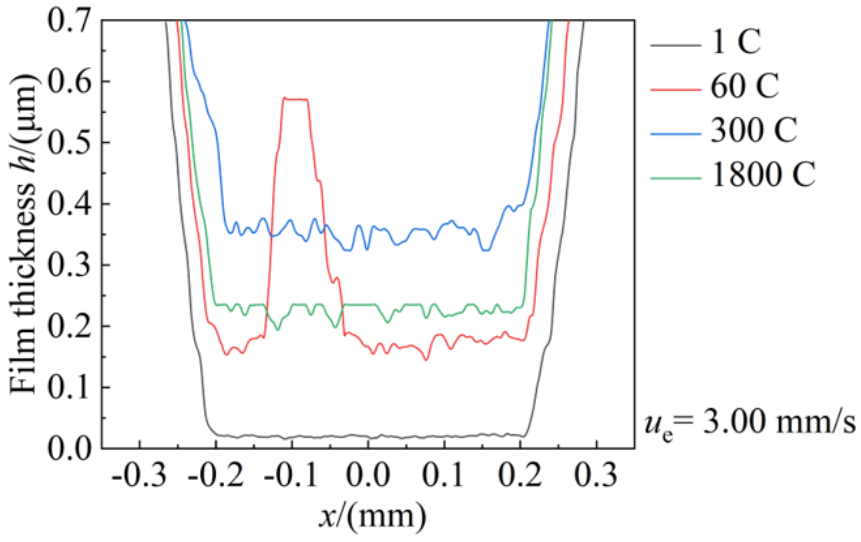
4.2 Film forming property under reciprocating movement

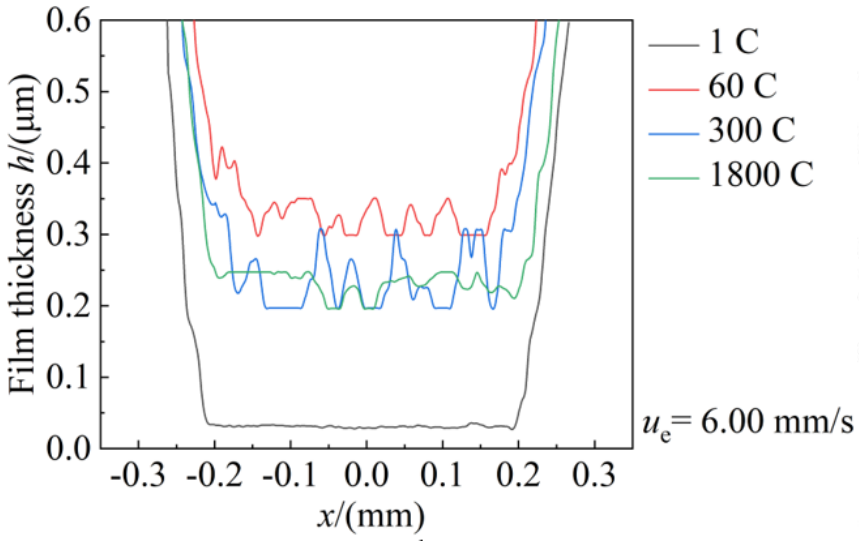


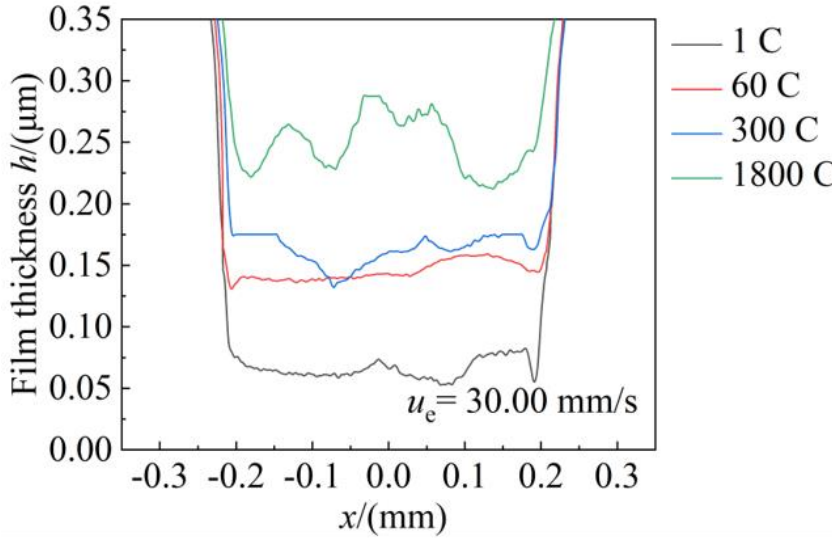
4.2 Film forming property under reciprocating movement

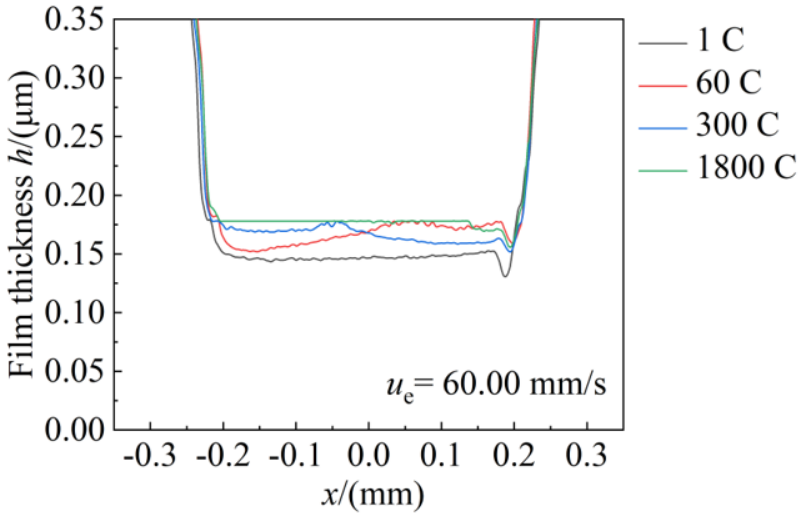


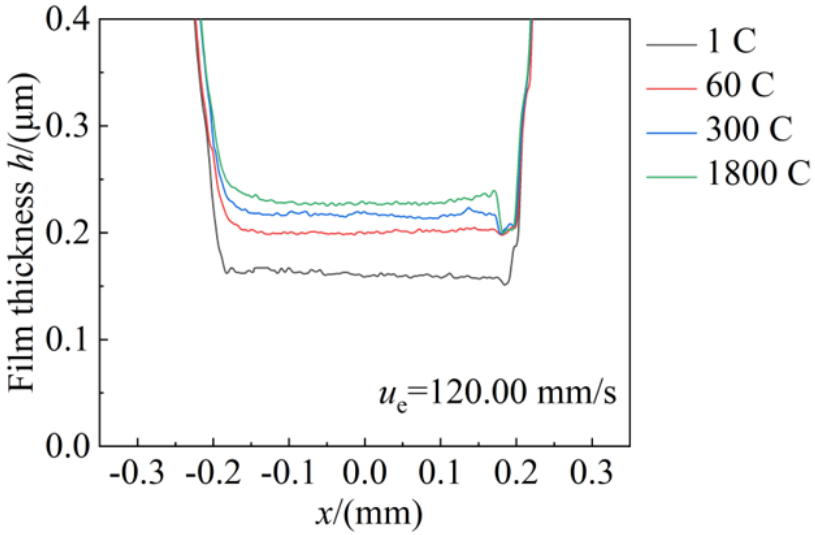
4.2 Film forming property under reciprocating movement

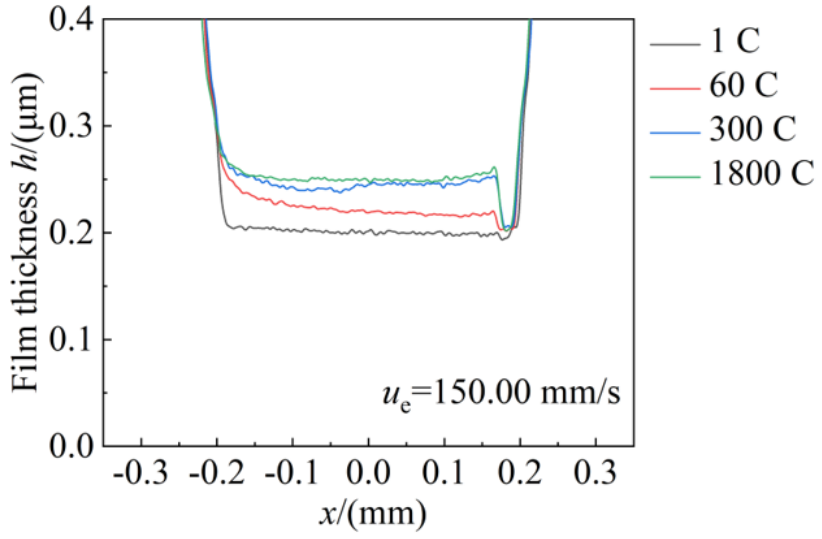




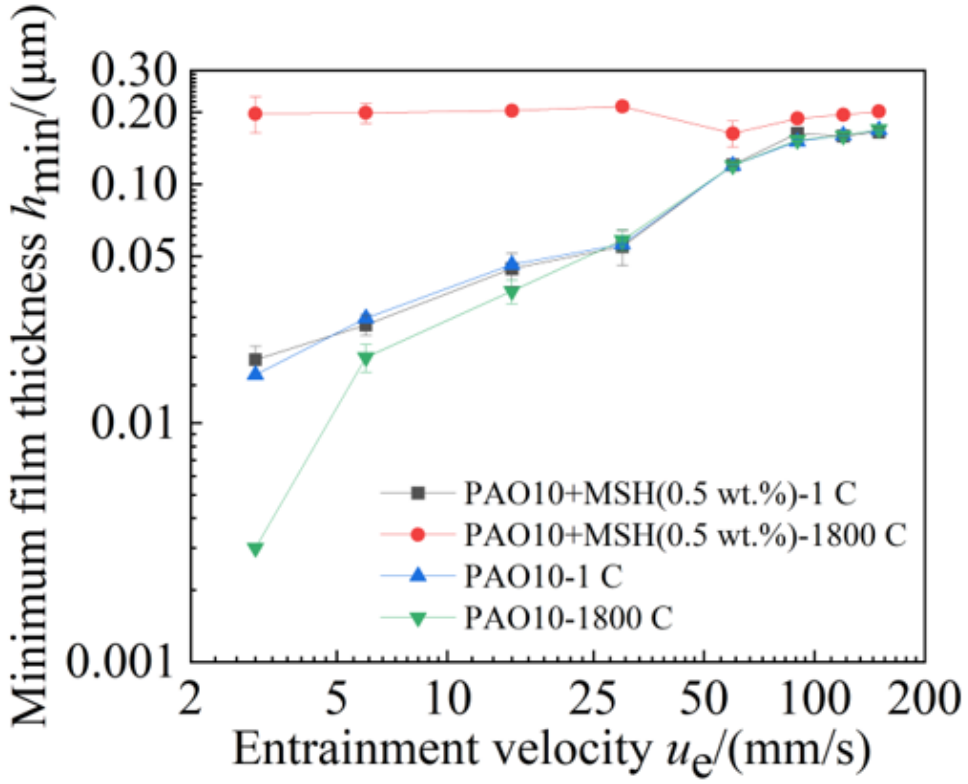




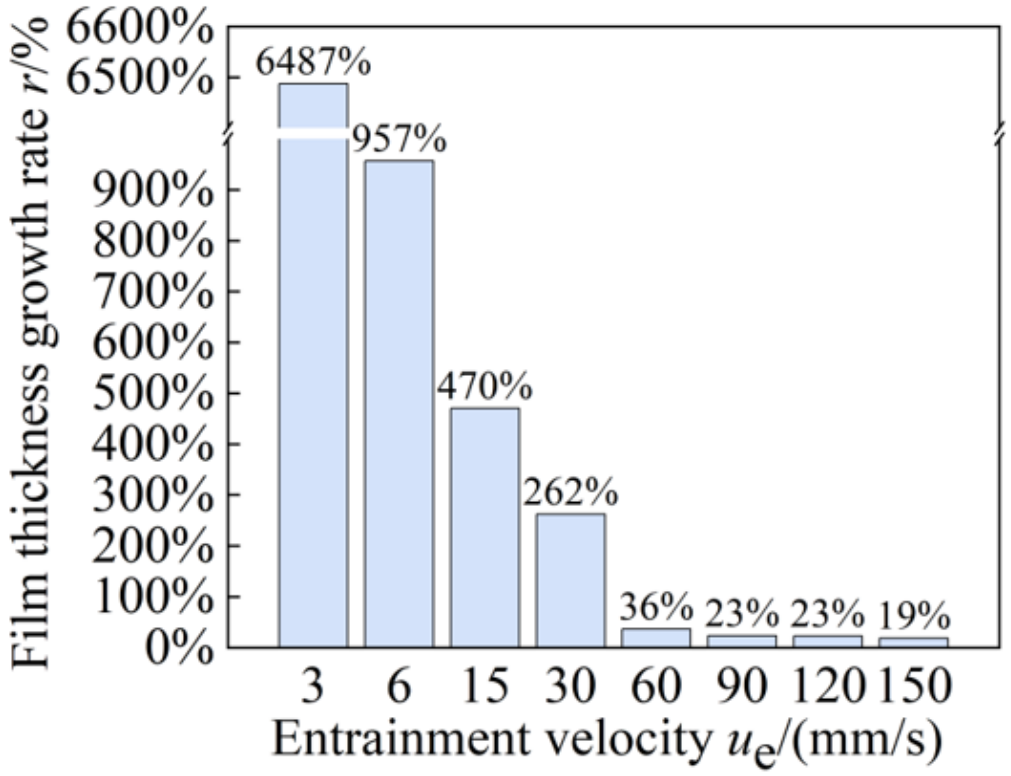




4.2 Film forming property under reciprocating movement

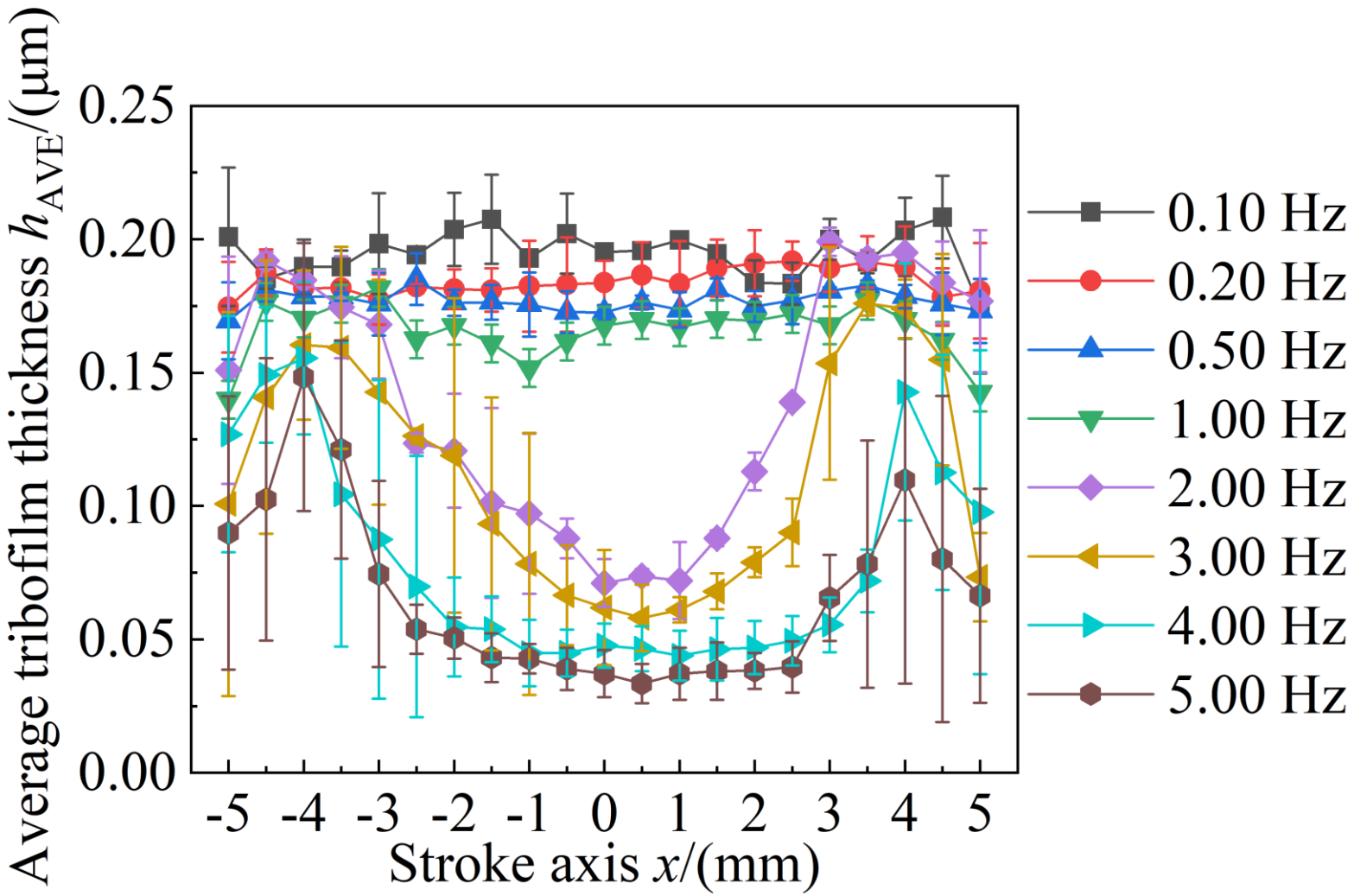


(a)

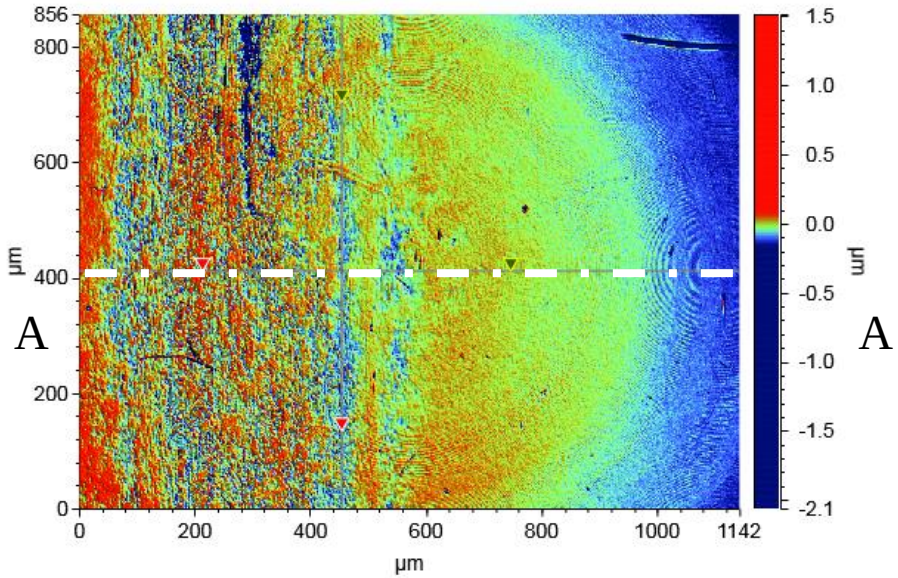


(b)

4.2 Film forming property under reciprocating movement



Surface topography



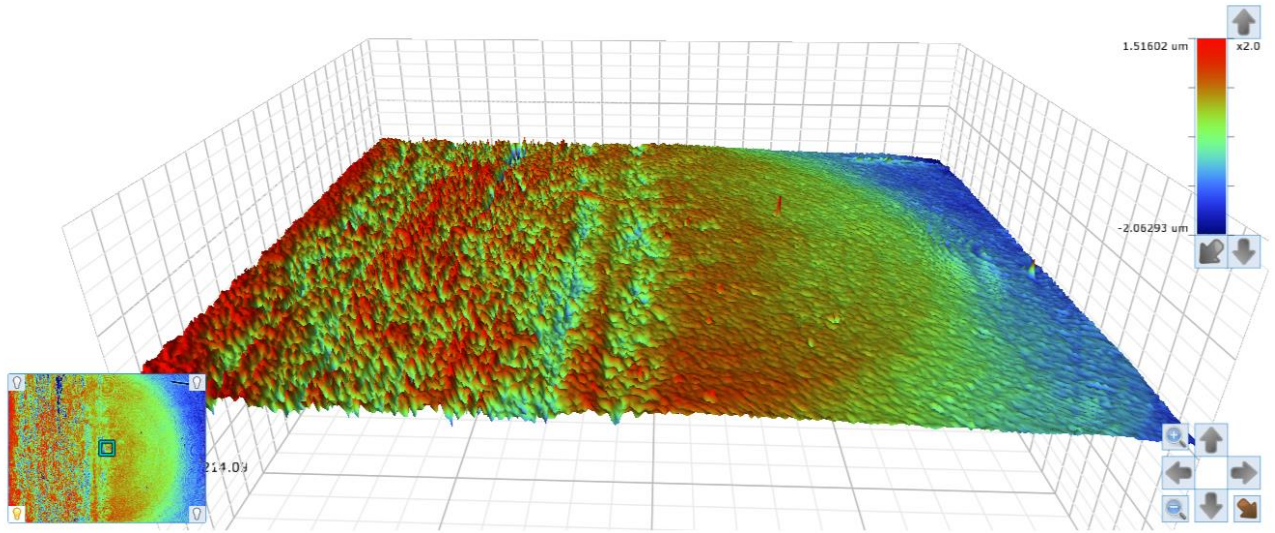


Fig. 4.10 Surface topography after PAO10+0.5wt% experiment

5 Conclusions

1 MSH has the best film forming property than the other particles tested.

2 The solid film formed in the presence of MSH.

3 The solid film thickness is dependent on the velocity and load.

Team


思源求索 致远
1958-2000-2020
20th Anniversary Celebration
北京交通大学机械与电子控制工程学院
建院20周年暨办学62周年
Snacks & naps

Patents

[1] 常秋英，纳米羟基硅酸镁的制备方法，抗磨剂的制备方法及应用，ZL 2015 1 0409607.x

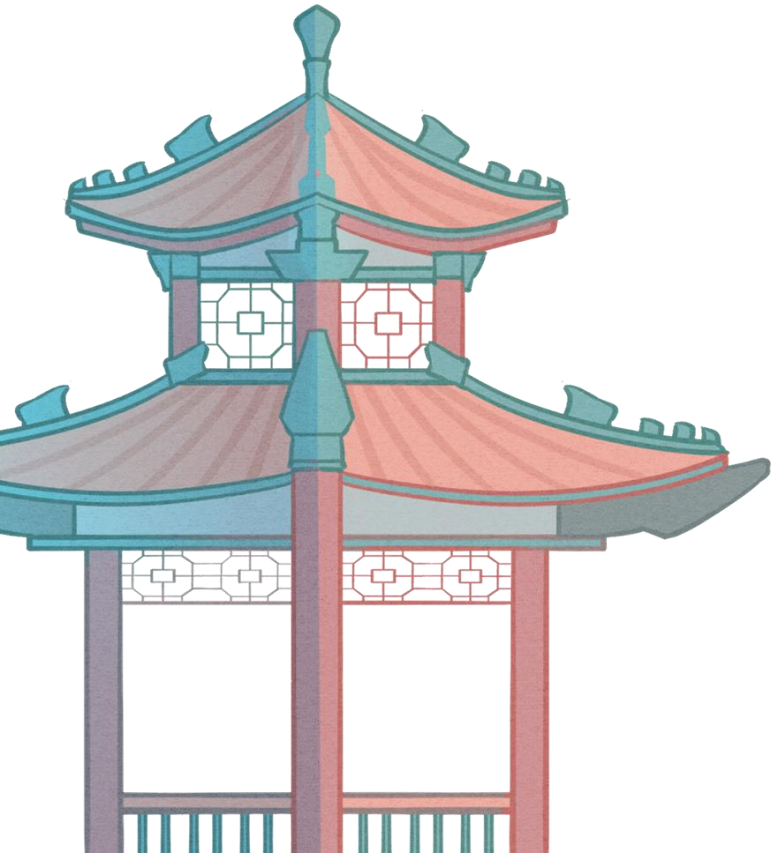
[2] 常秋英，乔娇飞，一种粘结型固体润滑涂料及制备方法，ZL 2015 1 0381301.8

[3] Ali ERDEMIR, Vilas G. POL., Michael M. THACKERAY, Kuldeep MISTRY, 常秋英，Carbon Nanofiber materials and lubricant，US 2015/0166921 A1

[4] 常秋英，高凯，一种枝接脂肪酸制备复合抗磨添加剂的方法，201710717538.8

[5] 常秋英，高凯，一种在羟基硅酸镁纳米颗粒表面包覆无定形碳的方法，201811406222.8

[6] 常秋英，张浩，纳米羟基硅酸镁-氟掺杂无定型碳复合抗磨剂的制备方法，201910558696.8



Thanks