明治大学学術フロンティア
信頼性データバンク疲労データシート

Meiji University Academic Frontier
Reliability Data Bank Fatigue Data Sheet

ボールねじの寿命試験特性データシート

Data Sheet on Fatigue Properties of Ball Screw by Life Test

Project of Meiji University Academic Frontier

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PARTICULARS FOR MECHANICAL P-S-N TEST

Table.1 Test machine properties

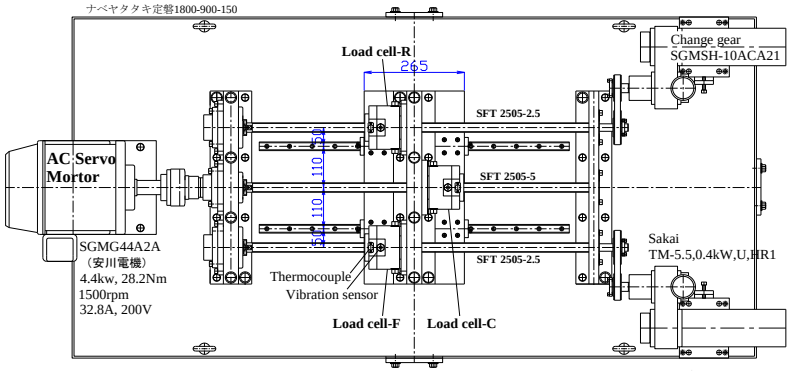
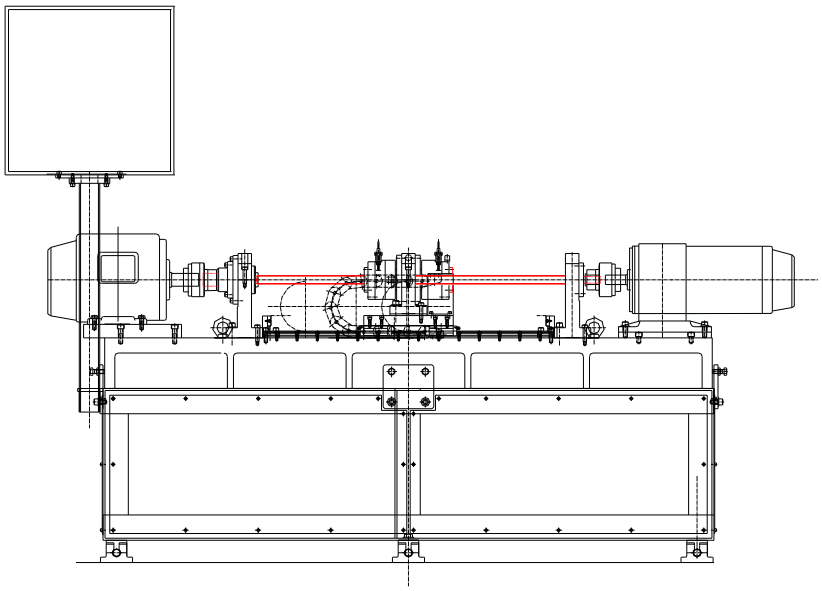
Machine type	3-ball screw life test machine
Motor	4.4kw 28.8Nm
Frequency	0~80Hz
	 

Table.2 Estimation parameters by log-normal distribution function

Load	6.5 (kN)
μ	15.5
σ	0.74
σ/μ	0.05

Table.3 Estimation parameters by two-parameter Weibull distribution function

Load	6.5 (kN)
M	1.73
η	21.47(10^6rev)

Table.4 Estimation parameters by three-parameter Weibull distribution function

Load	6.5 (kN)
m	10/9
η	20.49 (10^6rev)
γ	2.47 (10^6rev)

Table.5 Estimation parameters by log-normal distribution function

Load	5.5 (kN)
μ	30.2
σ	0.66
σ/μ	0.02

Table.4 Estimation parameter by two-parameter Weibull distribution function

Load	5.5 (kN)
m	1.85
η	42.11(10^6rev)

Table.5 Estimation parameter by three-parameter Weibull distribution function

Load	5.5 (kN)
m	10/9
η	45.13 (10^6rev)
γ	7.20 (10^6rev)

Table.6 Number of cycles to failures of ball screw (#2505-2.5, F_a=6.5kN)

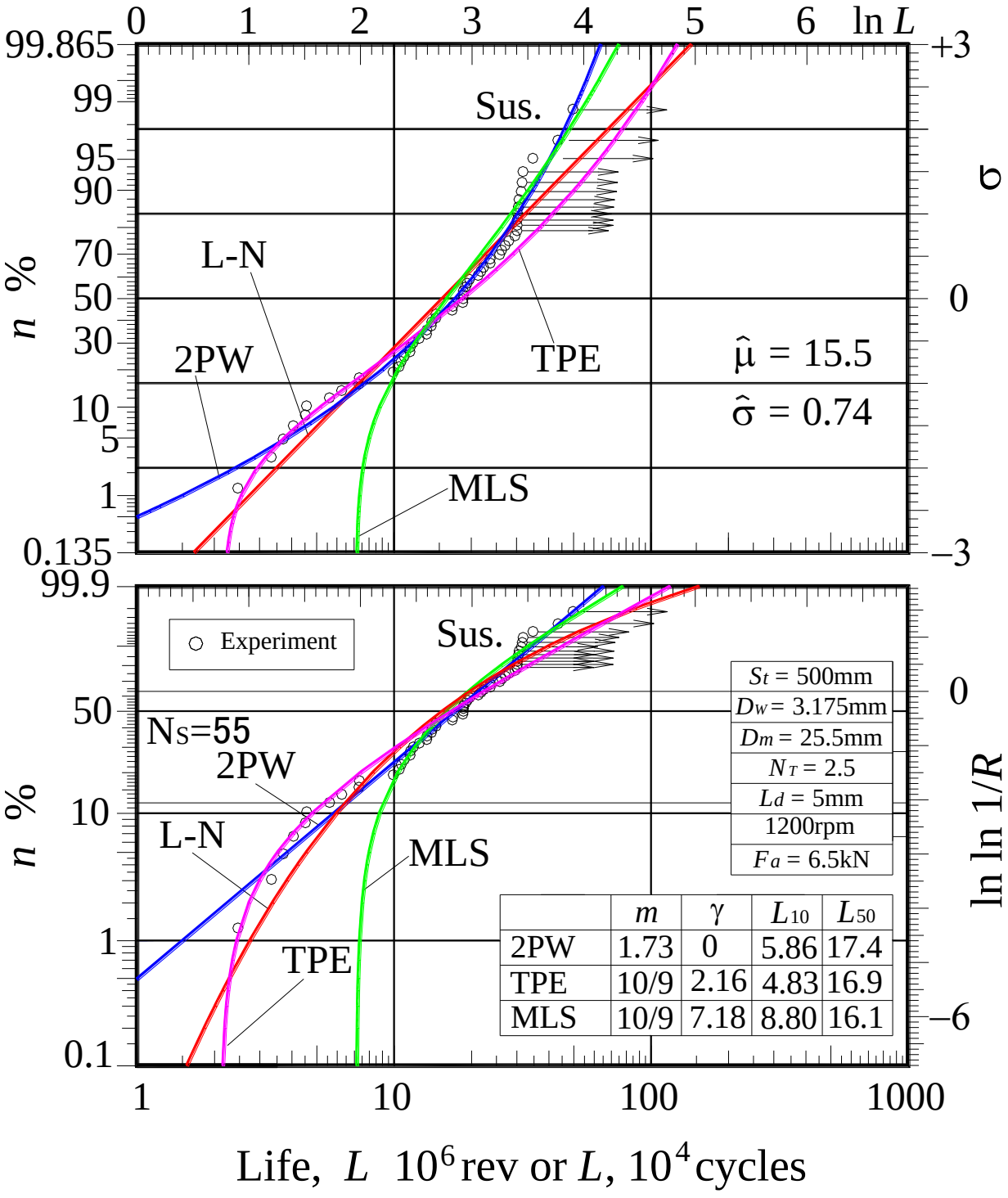
No,	Total revolution (10^6rev)
1	2.47
2	3.33
3	3.70
4	4.05
5	4.51
6	4.56
7	5.60
8	6.25
9	7.29
10	7.32
11	9.91
12	10.46
13	10.65
14	10.94
15	11.53
16	11.57
17	11.87
18	12.52
19	13.38
20	13.41
21	13.95
22	14.02
23	14.54
24	14.55
25	16.49
26	16.82
27	16.92
28	18.50
29	18.58
30	18.59
31	18.60
32	18.94
33	19.65
34	21.23
35	21.77
36	22.29
37	23.66
38	23.66
39	25.75
40	26.22
41	27.04
42	27.96
43	29.52
44	30.08
45	30.13
46	30.16
47	30.22
48	30.45
49	30.63
50	31.23
51	31.48
52	31.73
53	43.38
54	45.69
55	49.63

Table.7 Number of cycles to failures of ball screw (#2505-5, F_a= 13kN)

No,	Total revolution (10^6rev)
1	11.0031
2	11.8485
3	12.5195
4	22.5632
5	28.2211
6	29.6007
7	30.1037
8	30.7817
9	34.6605
10	35.7392
11	35.7392
12	39.5381
13	39.6367
14	39.7927
15	40.5851
16	41.1914
17	50.7575
18	52.4142

Table.8 Number of cycles to failures of ball screw (#2505-2.5, F_a= 5.5kN)

No,	Total revolution (10^6rev)
1	12.7264
2	19.9023
3	20.1994
4	20.3555
5	24.8475
6	30.2853
7	48.5736
8	50.0264
9	58.0011
10	64.6677
11	70.6818



	m	γ	L_{10}	L_{50}
2PW	1.73	0	5.86	17.4
TPE	10/9	2.16	4.83	16.9
MLS	10/9	7.18	8.80	16.1

Fig. 1 Life distribution Weibull and log-normal plot of ball screw (#2505-2.5, F_a=6.5kN)

$$\hat{C} = 8370\ \mathrm{N}$$

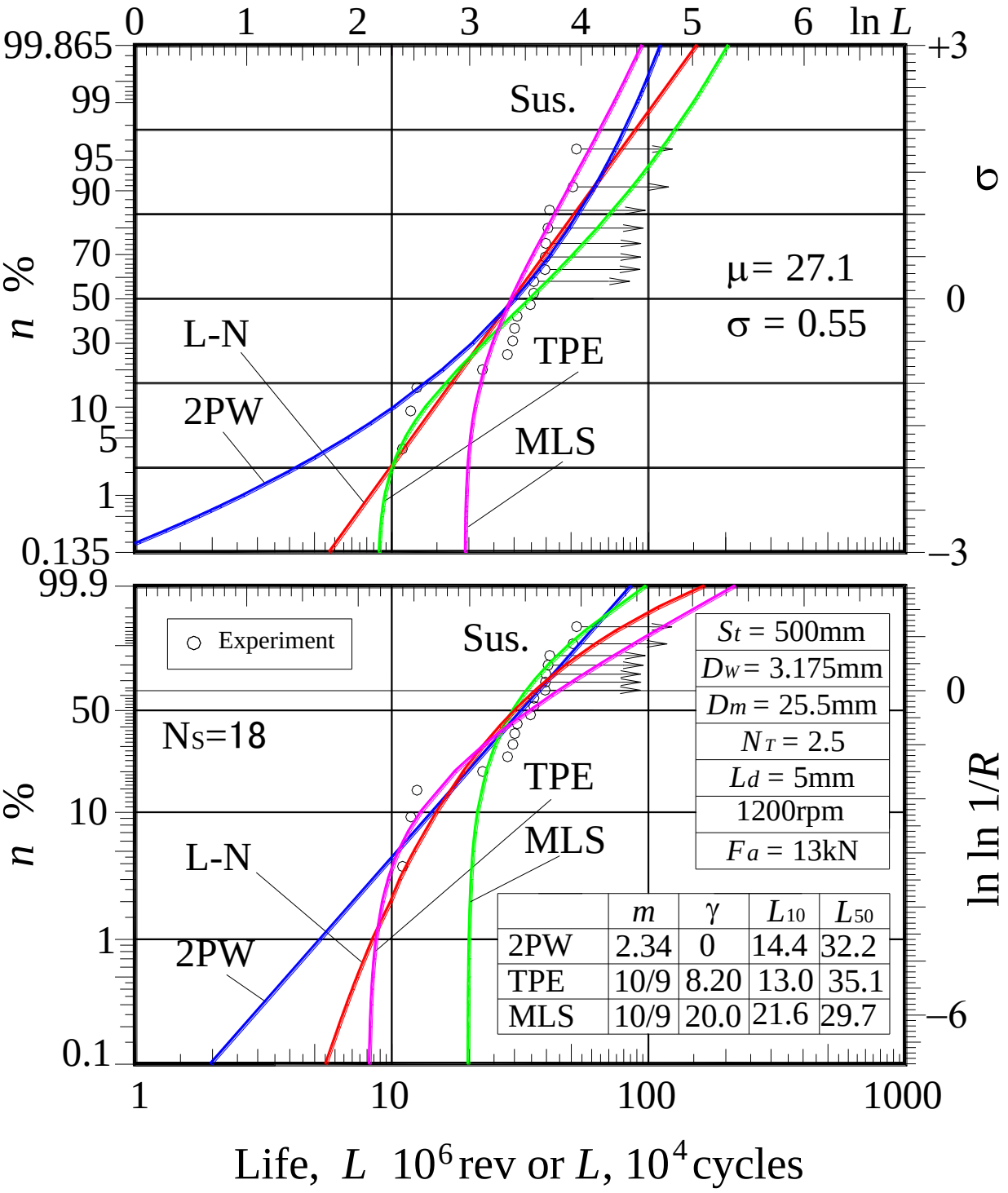
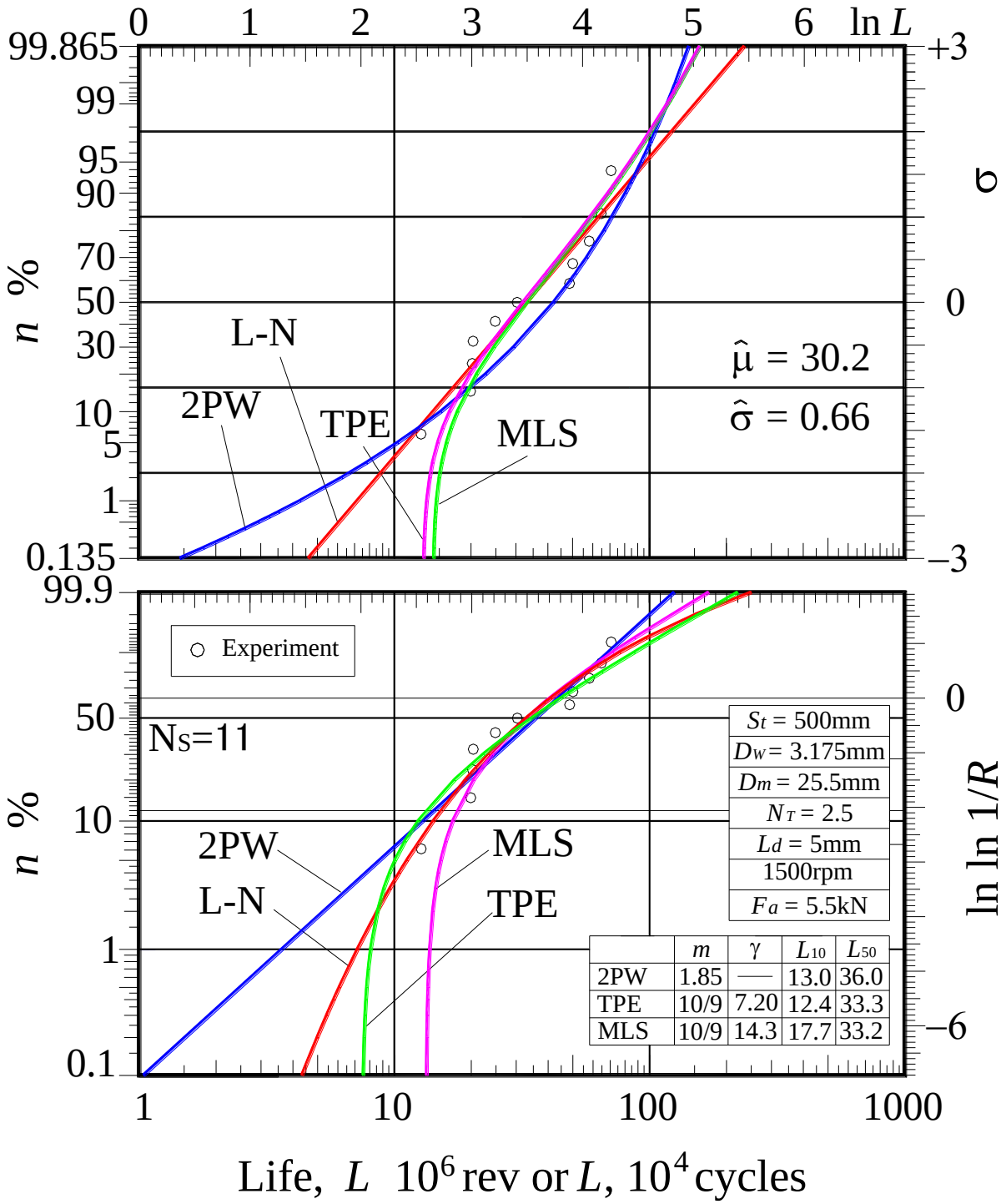


Fig. 2 Life distribution Weibull and log-normal plot of ball screw (#2505-5 , F_a= 13kN)

$$\hat{C} = 12293\,\mathrm{N}$$



	m	γ	L10	L50
2PW	1.85	—	13.0	36.0
TPE	10/9	7.20	12.4	33.3
MLS	10/9	14.3	17.7	33.2

Fig. 3 Life distribution Weibull and log-normal plot of ball screw (#2505-2.5, F_a=5.5kN)

$\hat{C} = 8370$ N

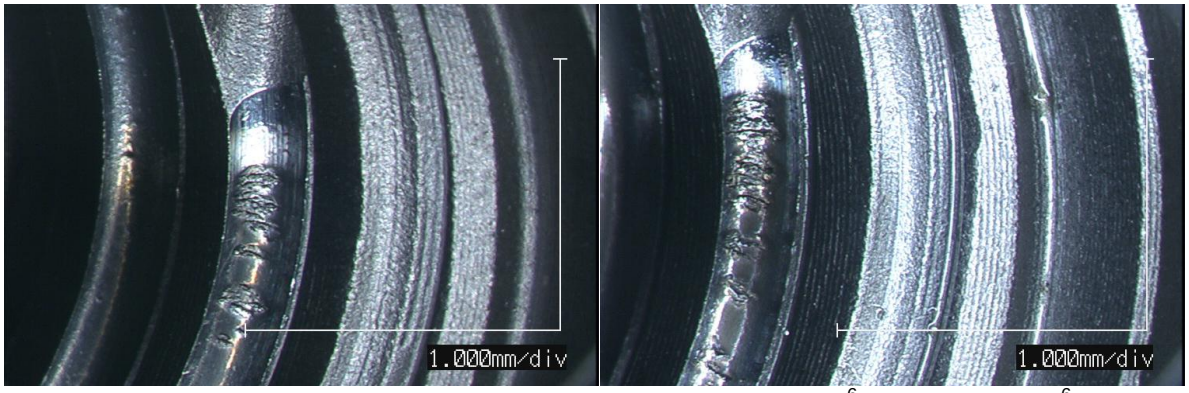


Fig.4 Spalling initiated on nut raceway after running 16.9×10^6rev and 14.0×10^6rev

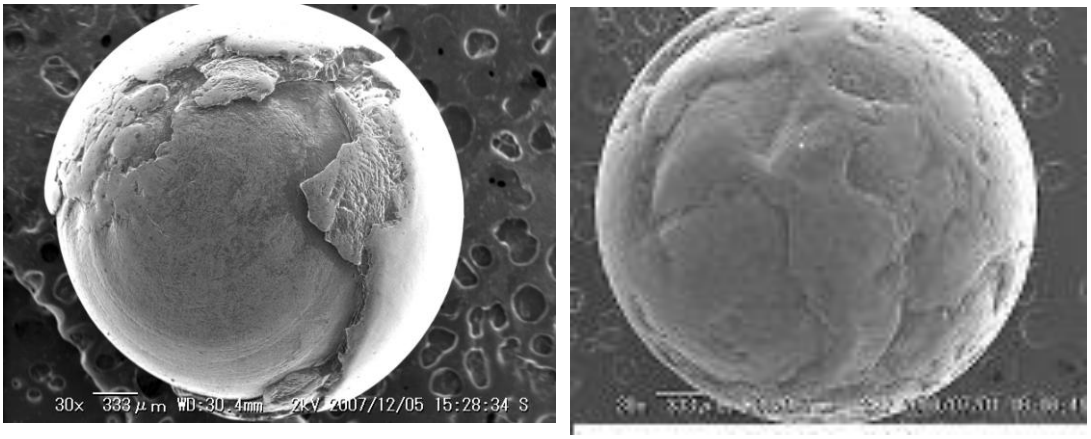


Fig. 5 Spalling initiated on ball surface after running 16.9×10^6rev and 13.9×10^6rev