FIG.1

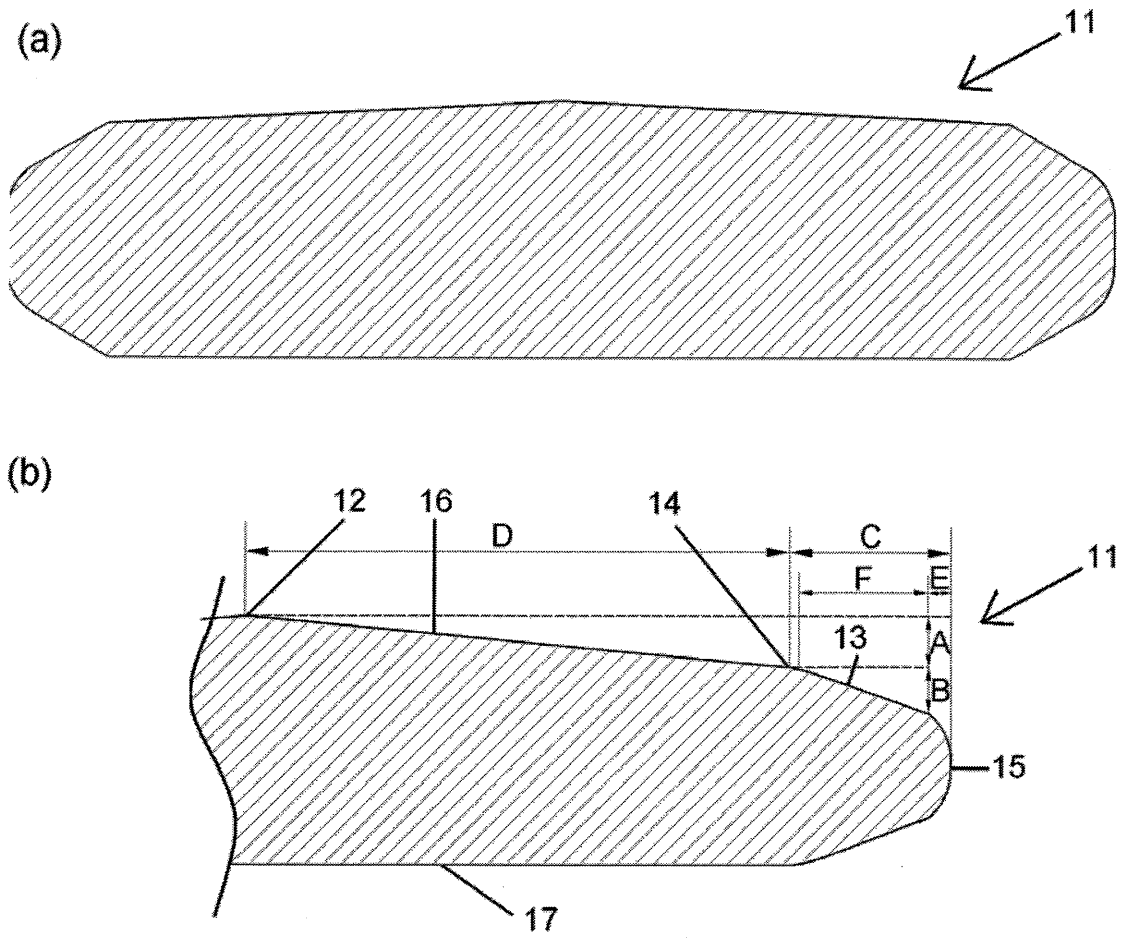


FIG.2

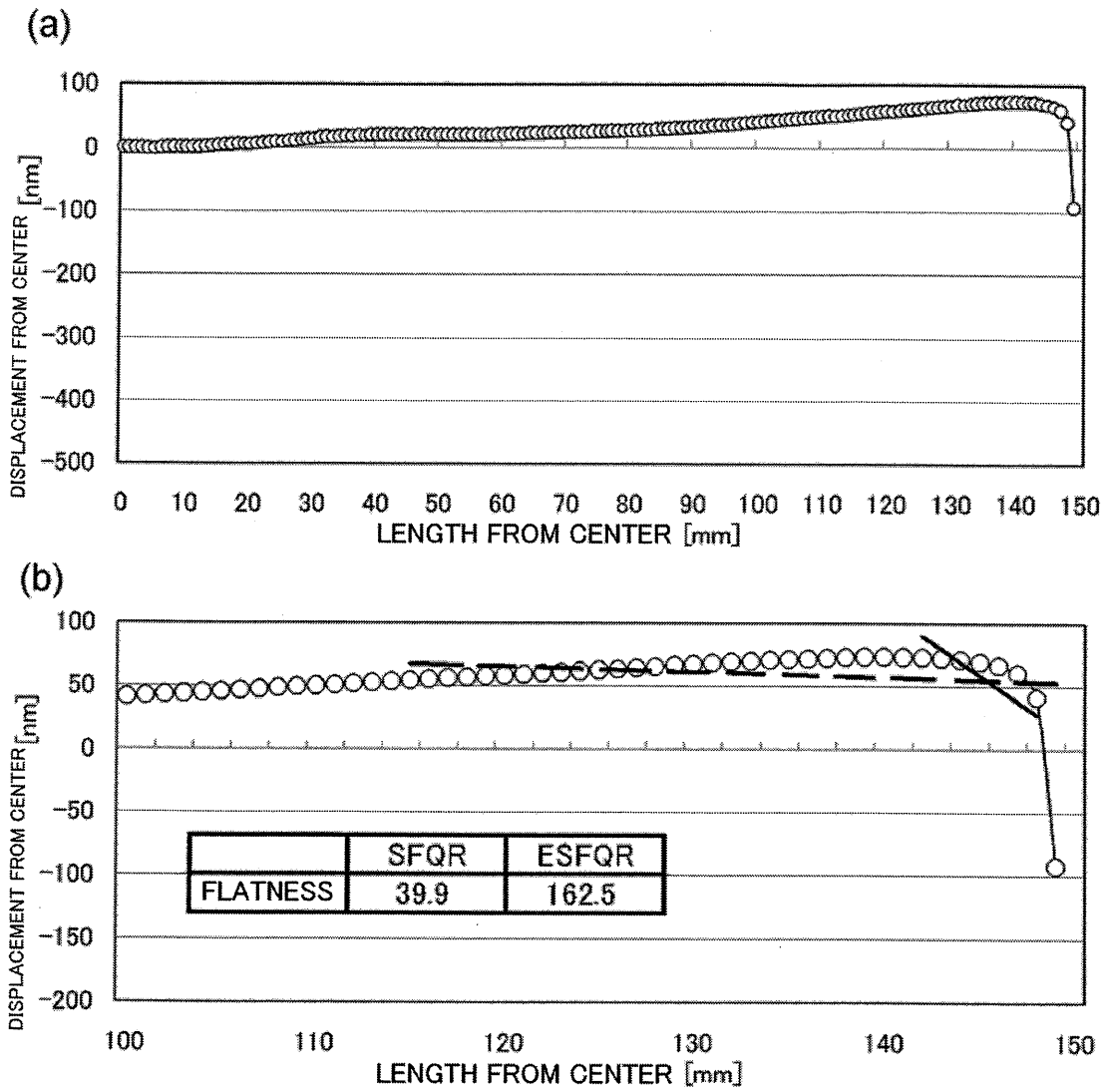

(a)
100
0
−100
−200
−300
−400
−500
DISPLACEMENT FROM CENTER [nm]
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
LENGTH FROM CENTER [mm]
(b)
100
50
0
−50
−100
−150
−200
DISPLACEMENT FROM CENTER [nm]
SFQR
ESFQR
FLATNESS
39.9
162.5
100 110 120 130 140 150
LENGTH FROM CENTER [mm]

FIG.3

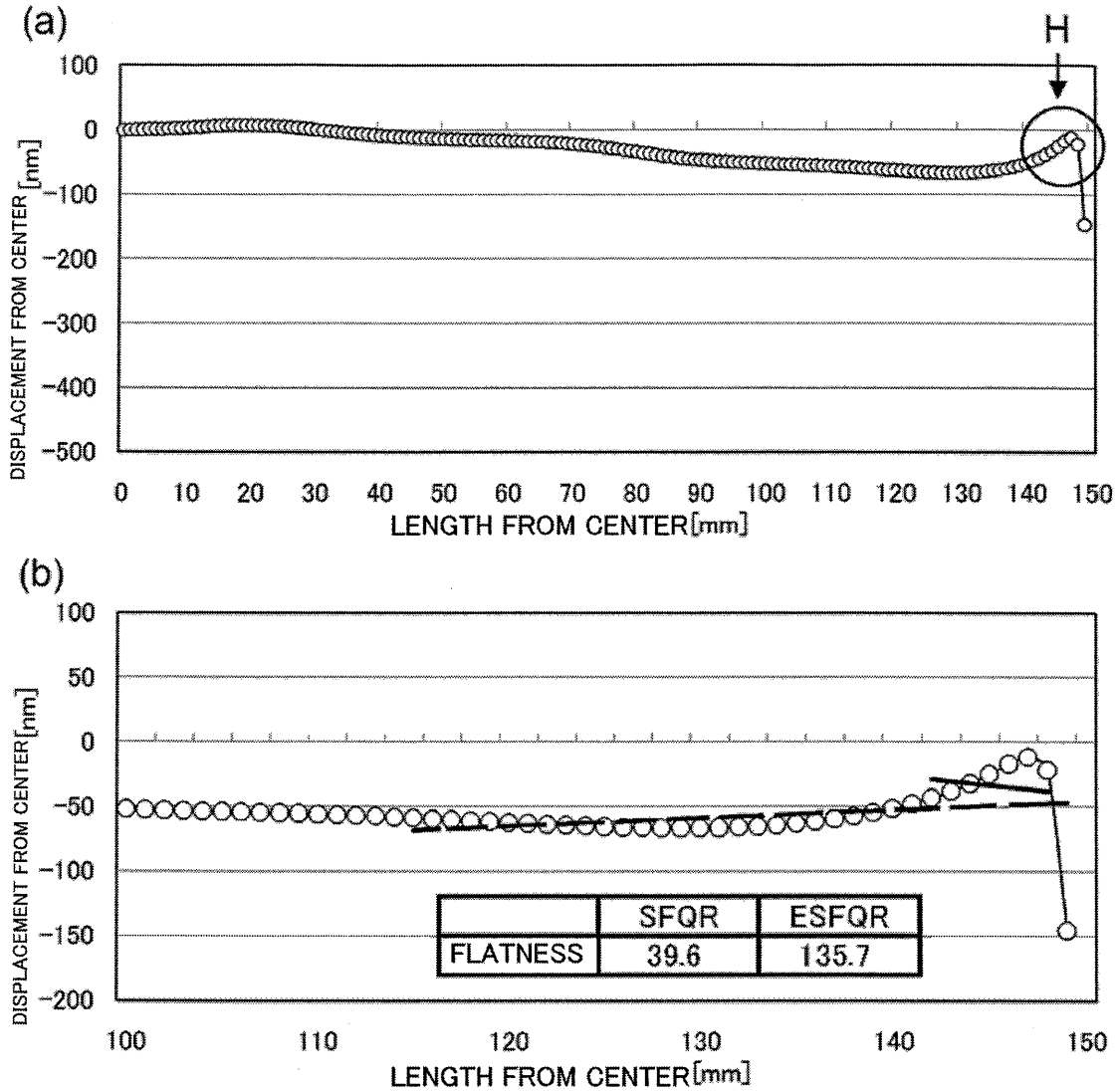

(a)
H
100
0
−100
−200
−300
−400
−500
DISPLACEMENT FROM CENTER [nm]
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
LENGTH FROM CENTER[mm]
(b)
100
50
0
−50
−100
−150
−200
DISPLACEMENT FROM CENTER[nm]
100 110 120 130 140 150
LENGTH FROM CENTER[mm]
SFQR
ESFQR
FLATNESS
39.6
135.7

FIG.4

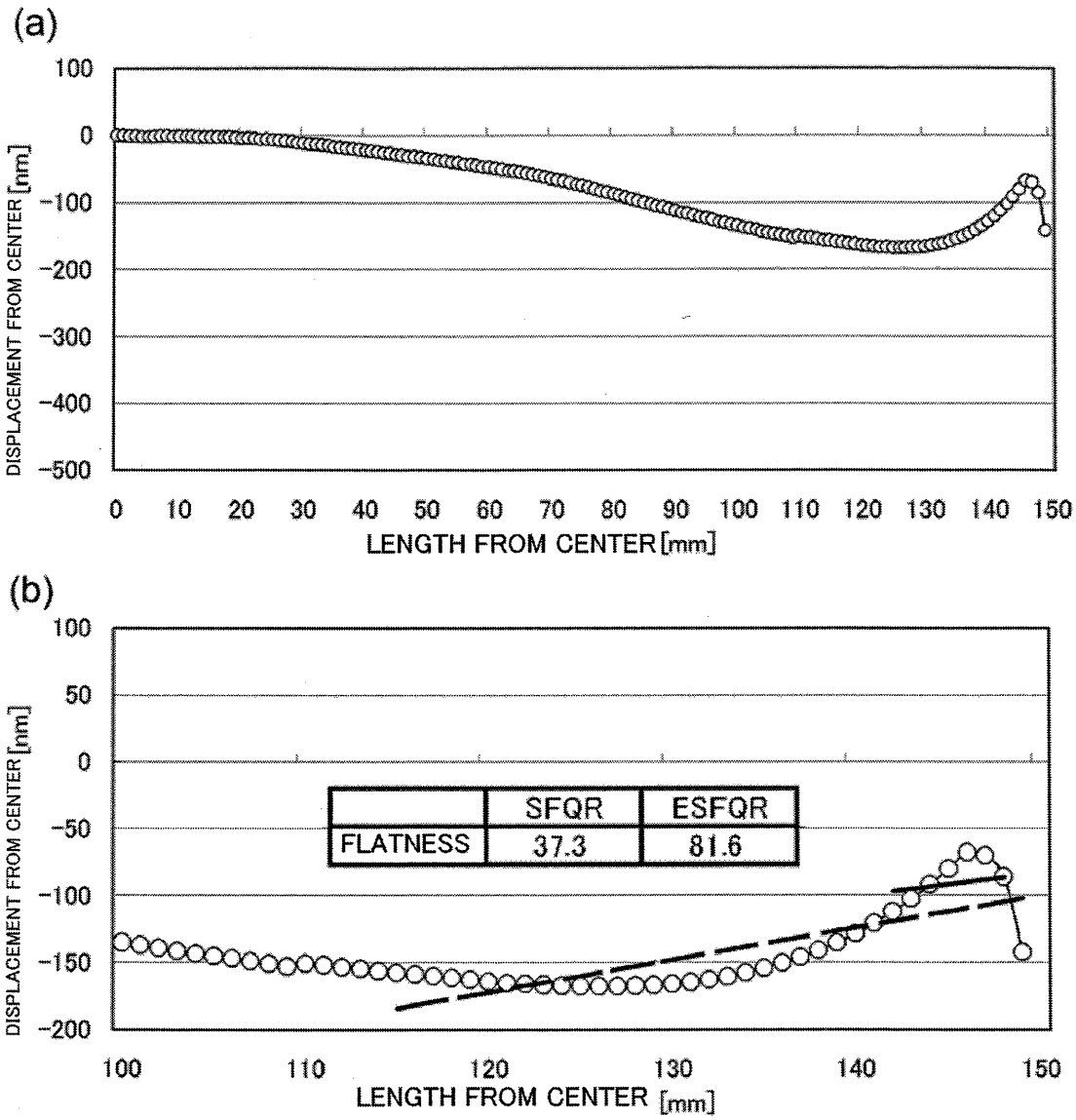

(a)
100
0
-100
-200
-300
-400
-500
DISPLACEMENT FROM CENTER [nm]
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
LENGTH FROM CENTER [mm]
(b)
100
50
0
-50
-100
-150
-200
DISPLACEMENT FROM CENTER [nm]
SFQR
ESFQR
FLATNESS
37.3
81.6
100 110 120 130 140 150
LENGTH FROM CENTER [mm]

FIG.5

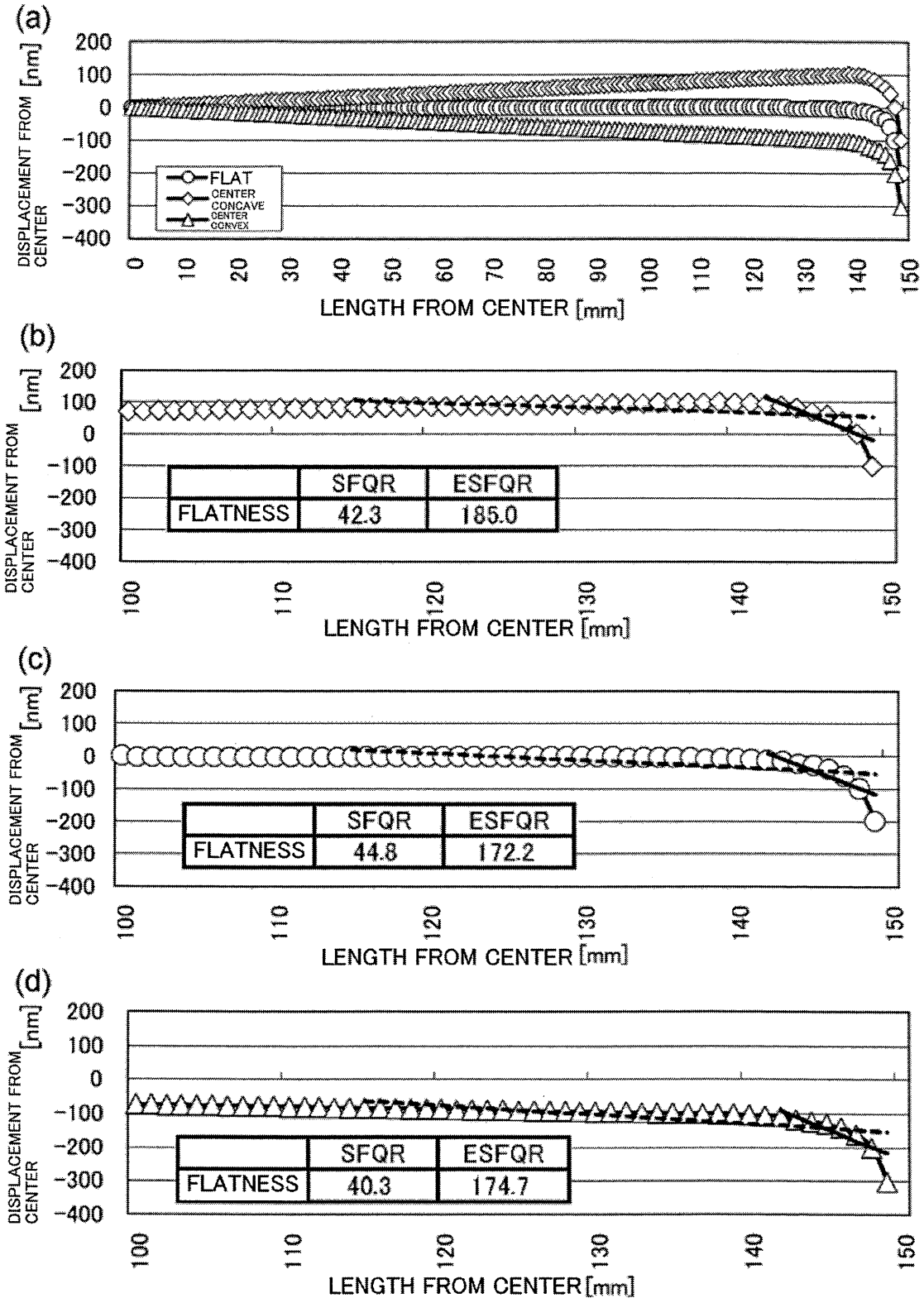

(a)
DISPLACEMENT FROM CENTER [nm]
200
100
0
-100
-200
-300
-400
FLAT CENTER
CONCAVE CENTER
CONVEX
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
LENGTH FROM CENTER [mm]
(b)
DISPLACEMENT FROM CENTER [nm]
SFQR ESFQR
FLATNESS 42.3 185.0
100 110 120 130 140 150
LENGTH FROM CENTER [mm]
(c)
DISPLACEMENT FROM CENTER [nm]
SFQR ESFQR
FLATNESS 44.8 172.2
100 110 120 130 140 150
LENGTH FROM CENTER [mm]
(d)
DISPLACEMENT FROM CENTER [nm]
SFQR ESFQR
FLATNESS 40.3 174.7
100 110 120 130 140 150
LENGTH FROM CENTER [mm]

FIG.6

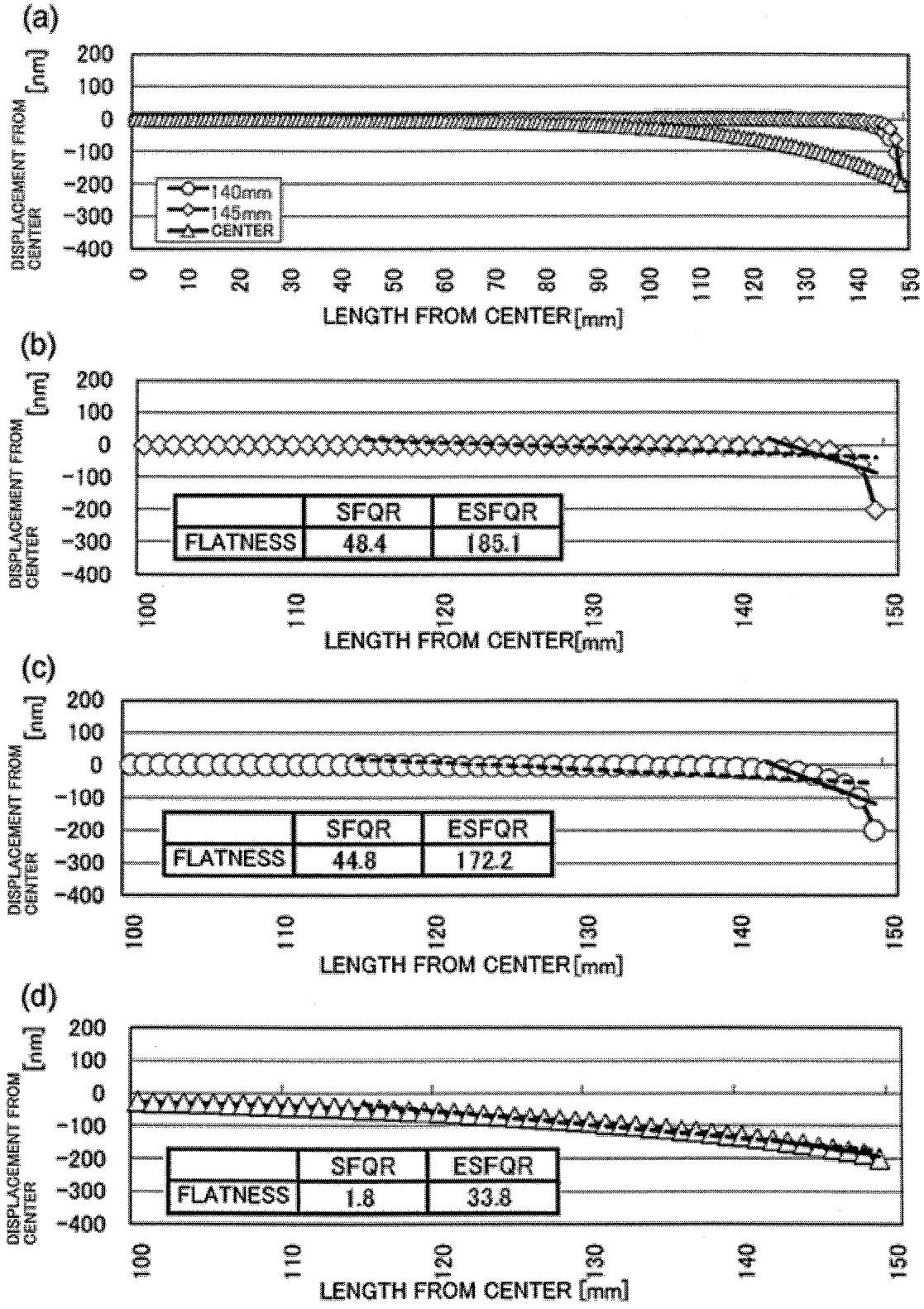

(a)
DISPLACEMENT FROM CENTER [nm]
200
100
0
-100
-200
-300
-400
140mm
145mm
CENTER
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
LENGTH FROM CENTER [mm]
(b)
DISPLACEMENT FROM CENTER [nm]
SFQR
ESFQR
FLATNESS
48.4
185.1
100
110
120
130
140
150
LENGTH FROM CENTER [mm]
(c)
DISPLACEMENT FROM CENTER [nm]
SFQR
ESFQR
FLATNESS
44.8
172.2
100
110
120
130
140
150
LENGTH FROM CENTER [mm]
(d)
DISPLACEMENT FROM CENTER [nm]
SFQR
ESFQR
FLATNESS
1.8
33.8
100
110
120
130
140
150
LENGTH FROM CENTER [mm]

FIG.7

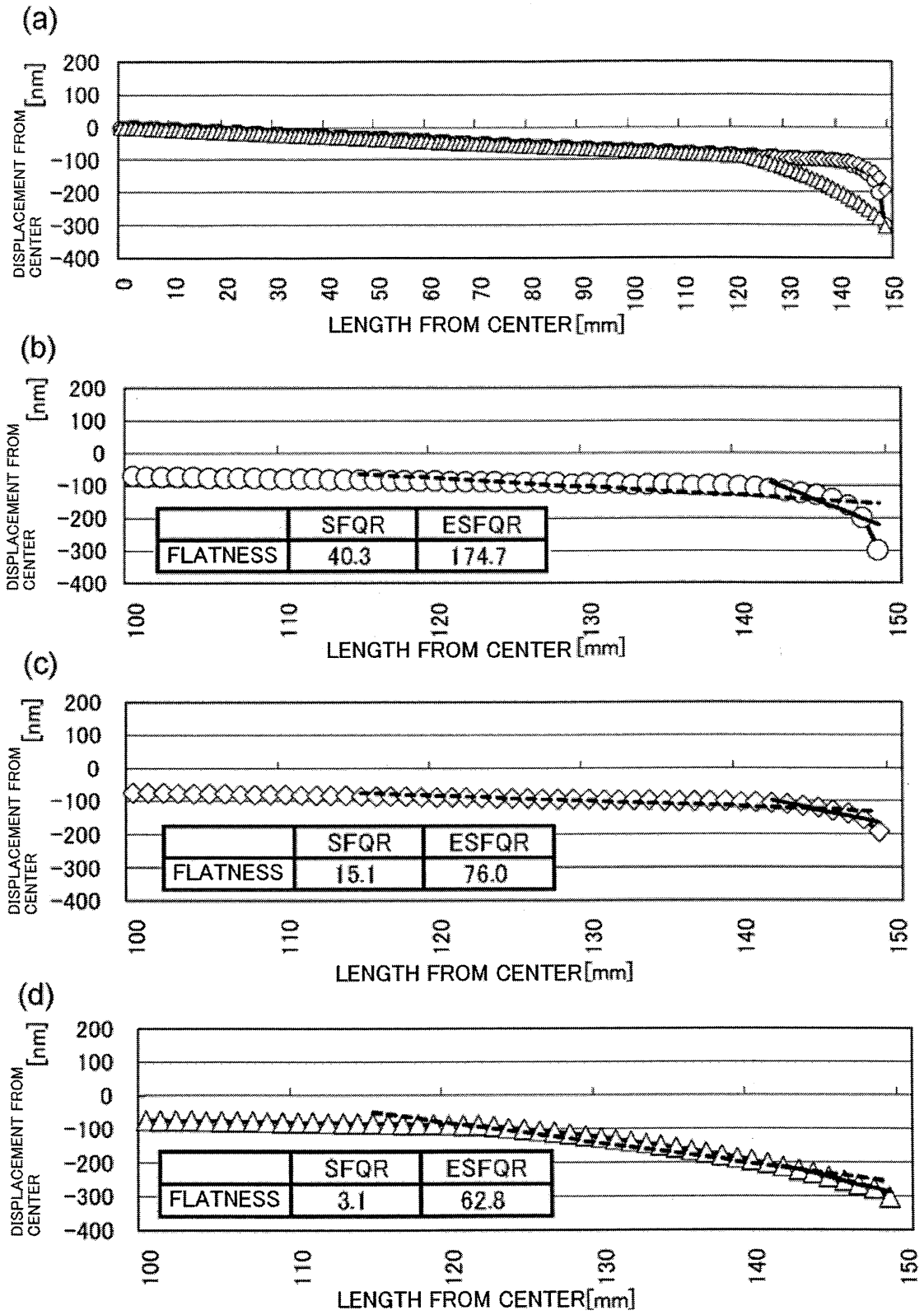

(a)
DISPLACEMENT FROM CENTER [nm]
200
100
0
-100
-200
-300
-400
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
LENGTH FROM CENTER [mm]
(b)
DISPLACEMENT FROM CENTER [nm]
200
100
0
-100
-200
-300
-400
SFQR ESFQR
FLATNESS 40.3 174.7
100 110 120 130 140 150
LENGTH FROM CENTER [mm]
(c)
DISPLACEMENT FROM CENTER [nm]
200
100
0
-100
-200
-300
-400
SFQR ESFQR
FLATNESS 15.1 76.0
100 110 120 130 140 150
LENGTH FROM CENTER [mm]
(d)
DISPLACEMENT FROM CENTER [nm]
200
100
0
-100
-200
-300
-400
SFQR ESFQR
FLATNESS 3.1 62.8
100 110 120 130 140 150
LENGTH FROM CENTER [mm]

FIG.8

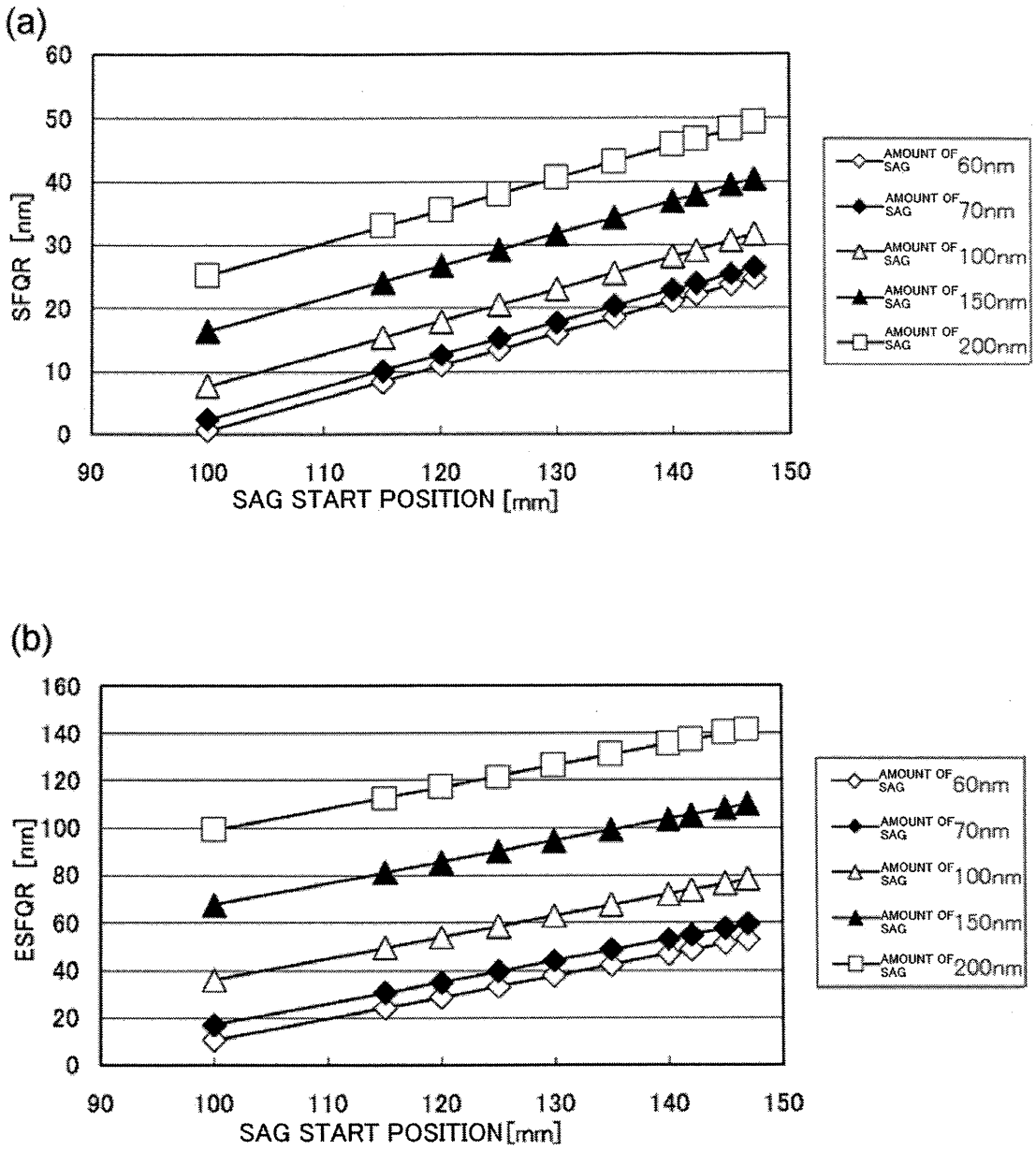

(a)
SFQR [nm]
60
50
40
30
20
10
0
90
100
110
120
130
140
150
SAG START POSITION [mm]
AMOUNT OF SAG 60nm
AMOUNT OF SAG 70nm
AMOUNT OF SAG 100nm
AMOUNT OF SAG 150nm
AMOUNT OF SAG 200nm
(b)
ESFQR [nm]
160
140
120
100
80
60
40
20
0
90
100
110
120
130
140
150
SAG START POSITION [mm]
AMOUNT OF SAG 60nm
AMOUNT OF SAG 70nm
AMOUNT OF SAG 100nm
AMOUNT OF SAG 150nm
AMOUNT OF SAG 200nm

FIG.9

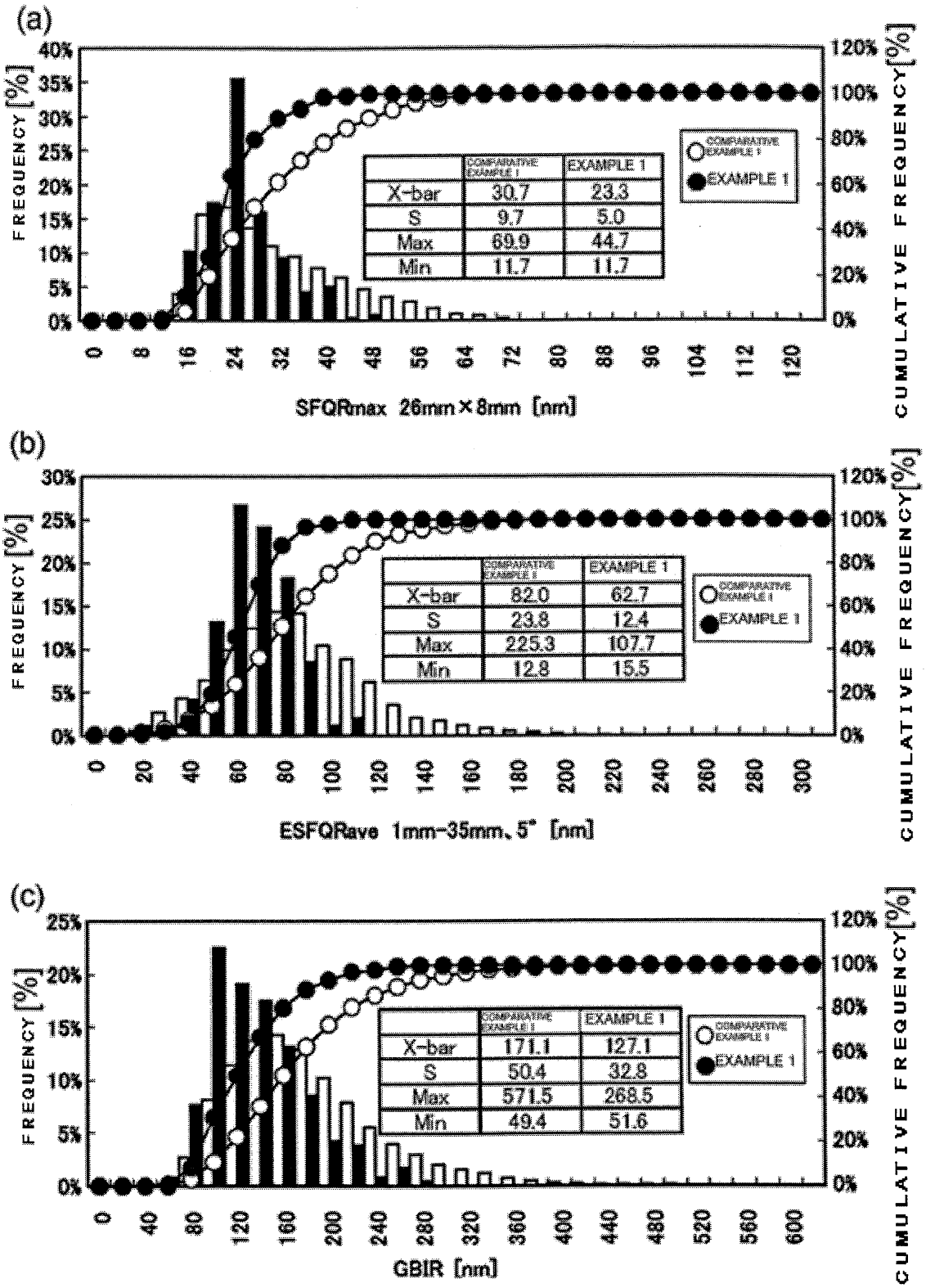

(a)
FREQUENCY [%]
CUMULATIVE FREQUENCY [%]
SFQRmax 26mm×8mm [nm]
COMPARATIVE EXAMPLE 1
EXAMPLE 1
X-bar 30.7 23.3
S 9.7 5.0
Max 69.9 44.7
Min 11.7 11.7
(b)
FREQUENCY [%]
CUMULATIVE FREQUENCY [%]
ESFQRave 1mm-35mm、5° [nm]
COMPARATIVE EXAMPLE 1
EXAMPLE 1
X-bar 82.0 62.7
S 23.8 12.4
Max 225.3 107.7
Min 12.8 15.5
(c)
FREQUENCY [%]
CUMULATIVE FREQUENCY [%]
GBIR [nm]
COMPARATIVE EXAMPLE 1
EXAMPLE 1
X-bar 171.1 127.1
S 50.4 32.8
Max 571.5 268.5
Min 49.4 51.6

FIG.10

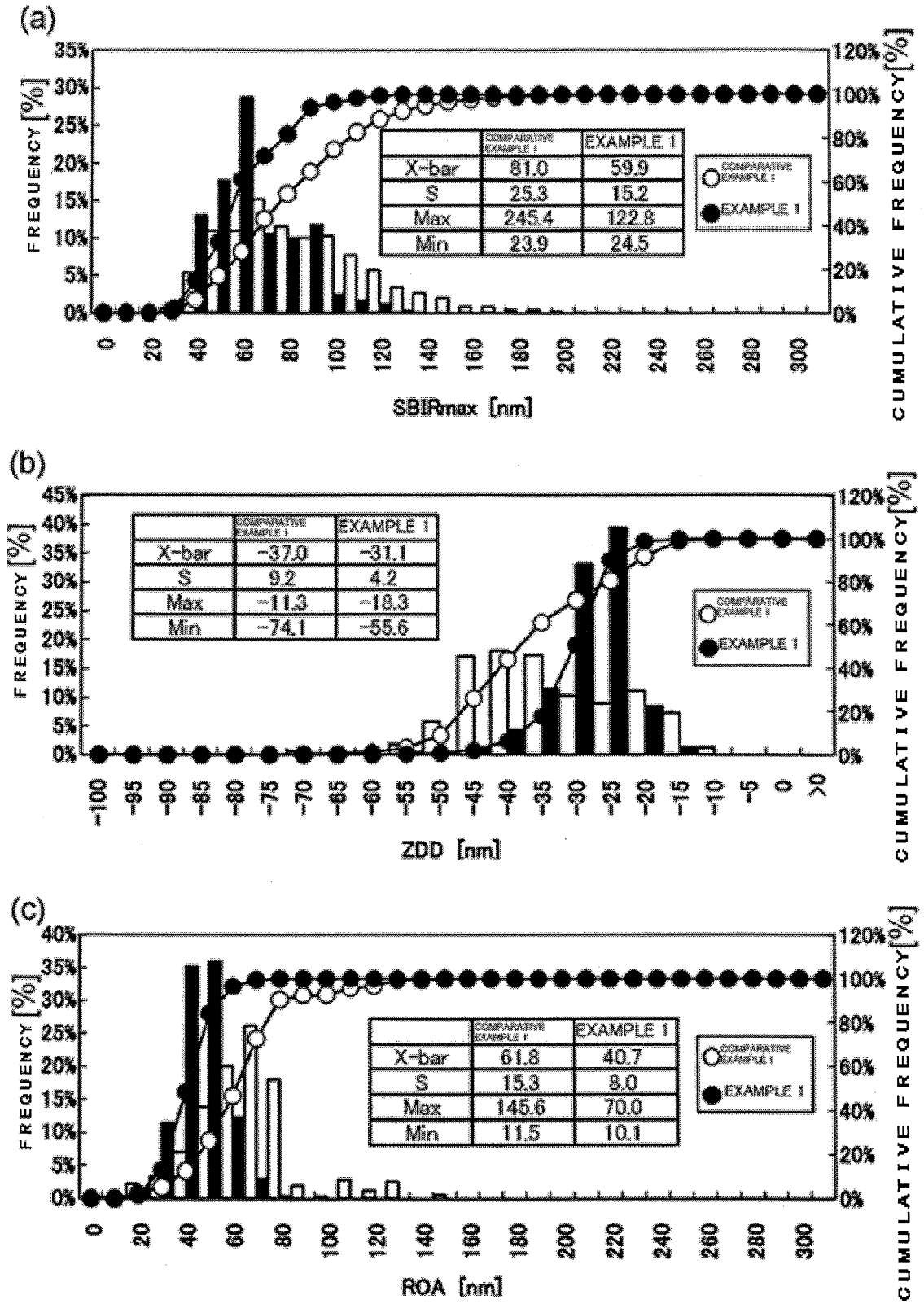

(a)
FREQUENCY [%]
CUMULATIVE FREQUENCY [%]
SBIRmax [nm]
COMPARATIVE EXAMPLE 1
EXAMPLE 1
X-bar 81.0 59.9
S 25.3 15.2
Max 245.4 122.8
Min 23.9 24.5
(b)
FREQUENCY [%]
CUMULATIVE FREQUENCY [%]
ZDD [nm]
COMPARATIVE EXAMPLE 1
EXAMPLE 1
X-bar -37.0 -31.1
S 9.2 4.2
Max -11.3 -18.3
Min -74.1 -55.6
(c)
FREQUENCY [%]
CUMULATIVE FREQUENCY [%]
ROA [nm]
COMPARATIVE EXAMPLE 1
EXAMPLE 1
X-bar 61.8 40.7
S 15.3 8.0
Max 145.6 70.0
Min 11.5 10.1

FIG.11

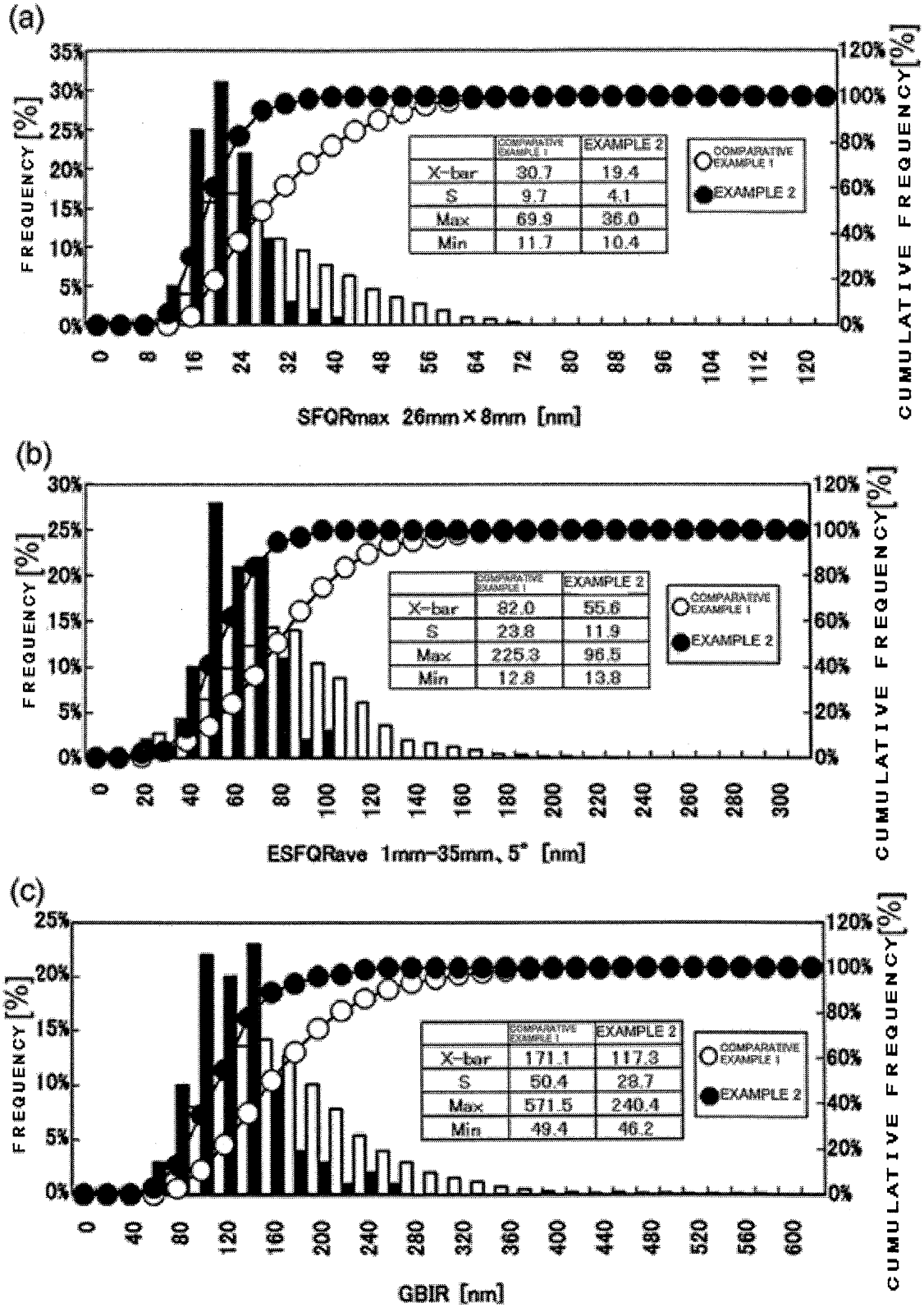

(a)
FREQUENCY [%]
CUMULATIVE FREQUENCY [%]
SFQRmax 26mm×8mm [nm]
COMPARATIVE EXAMPLE 1
EXAMPLE 2
X-bar 30.7 19.4
S 9.7 4.1
Max 69.9 36.0
Min 11.7 10.4
(b)
FREQUENCY [%]
CUMULATIVE FREQUENCY [%]
ESFQRave 1mm-35mm、5° [nm]
COMPARATIVE EXAMPLE 1
EXAMPLE 2
X-bar 82.0 55.6
S 23.8 11.9
Max 225.3 96.5
Min 12.8 13.8
(c)
FREQUENCY [%]
CUMULATIVE FREQUENCY [%]
GBIR [nm]
COMPARATIVE EXAMPLE 1
EXAMPLE 2
X-bar 171.1 117.3
S 50.4 28.7
Max 571.5 240.4
Min 49.4 46.2

FIG.12

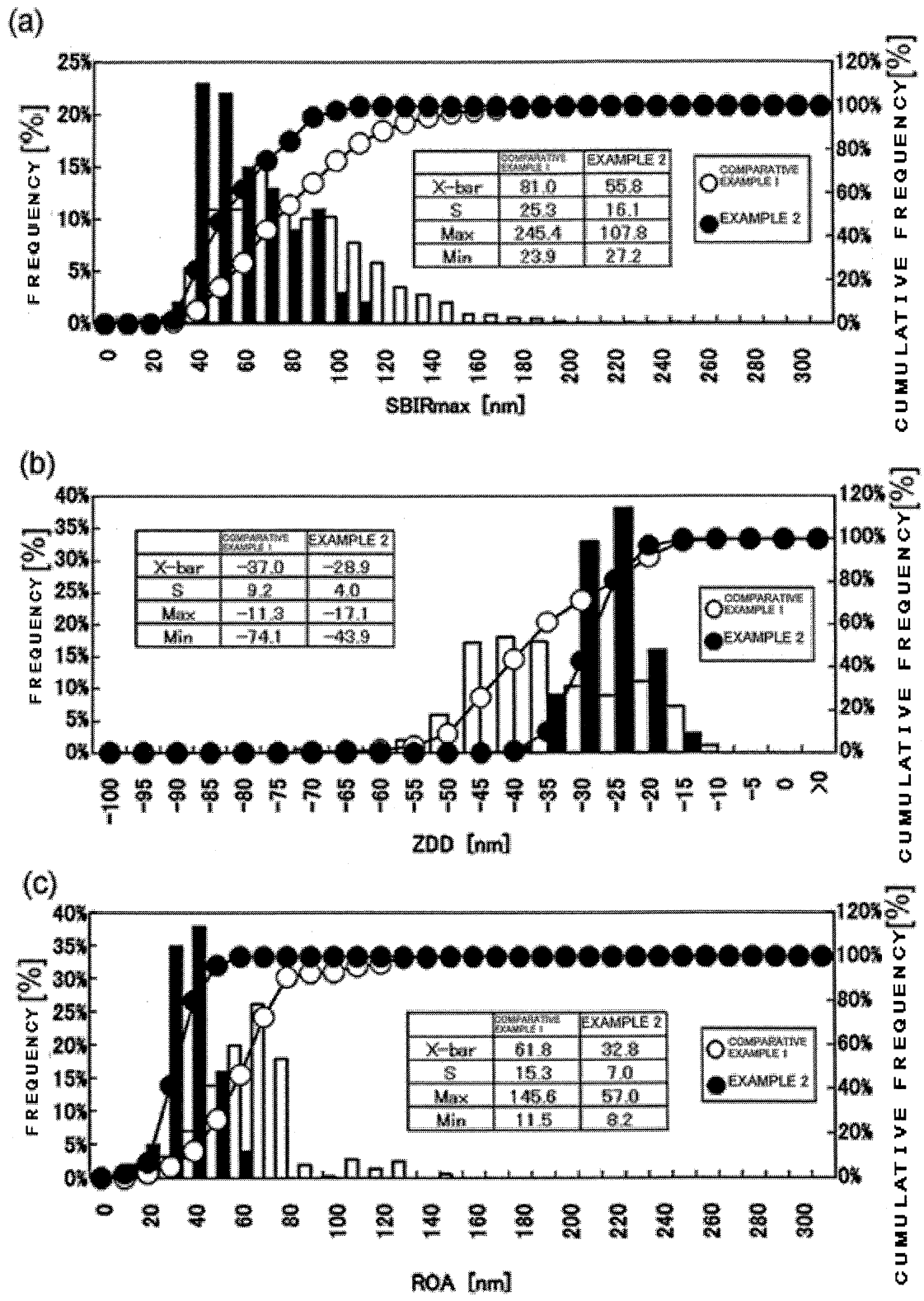

(a)
FREQUENCY [%]
CUMULATIVE FREQUENCY [%]
SBIRmax [nm]
COMPARATIVE EXAMPLE 1
EXAMPLE 2
X-bar 81.0 55.8
S 25.3 16.1
Max 245.4 107.8
Min 23.9 27.2
(b)
FREQUENCY [%]
CUMULATIVE FREQUENCY [%]
ZDD [nm]
COMPARATIVE EXAMPLE 1
EXAMPLE 2
X-bar −37.0 −28.9
S 9.2 4.0
Max −11.3 −17.1
Min −74.1 −43.9
(c)
FREQUENCY [%]
CUMULATIVE FREQUENCY [%]
ROA [nm]
COMPARATIVE EXAMPLE 1
EXAMPLE 2
X-bar 61.8 32.8
S 15.3 7.0
Max 145.6 57.0
Min 11.5 8.2

FIG.13

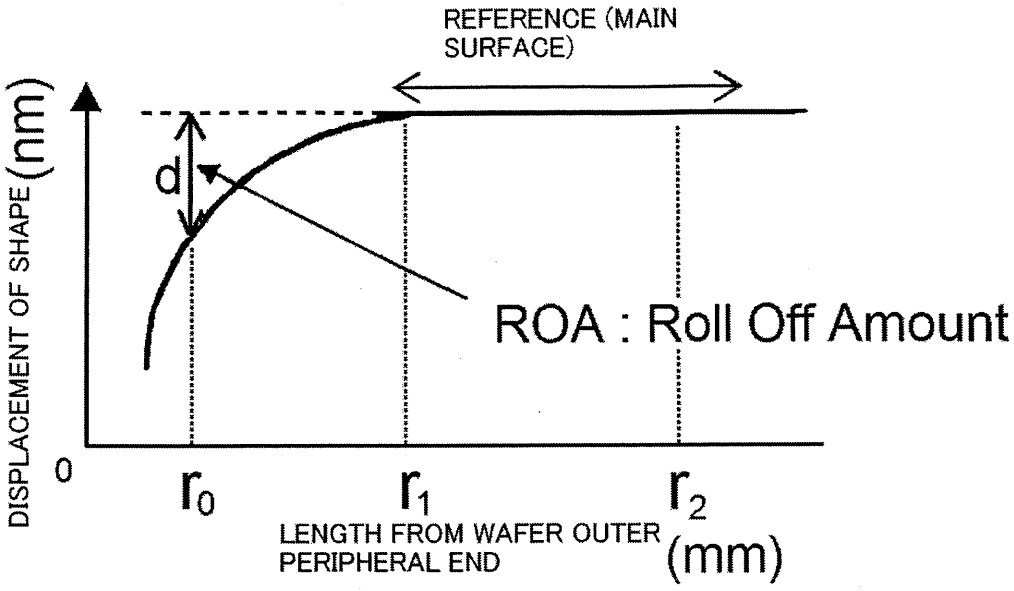
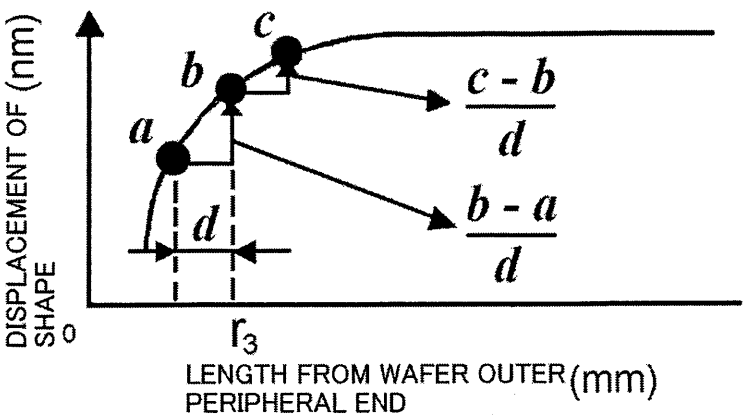

REFERENCE (MAIN SURFACE)
d
ROA : Roll Off Amount
DISPLACEMENT OF SHAPE (nm)
0
r0
r1
r2
LENGTH FROM WAFER OUTER PERIPHERAL END
(mm)

FIG.14



$$ZDD(R) \equiv \frac{\partial^2 \overline{Z}(R)}{\partial R^2} = \frac{c-b/d - b-a/d}{d} = \frac{c+a-2b}{d^2}$$

FIG.15

