FIG. 1



FIG. 2

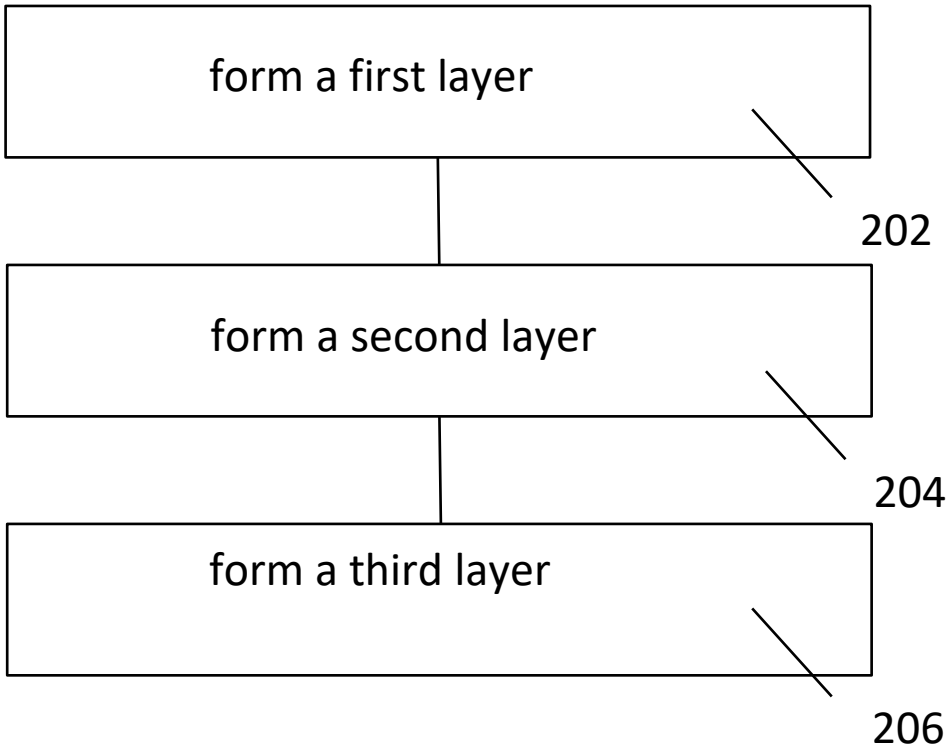

form a first layer
202
form a second layer
204
form a third layer
206

FIG. 3A

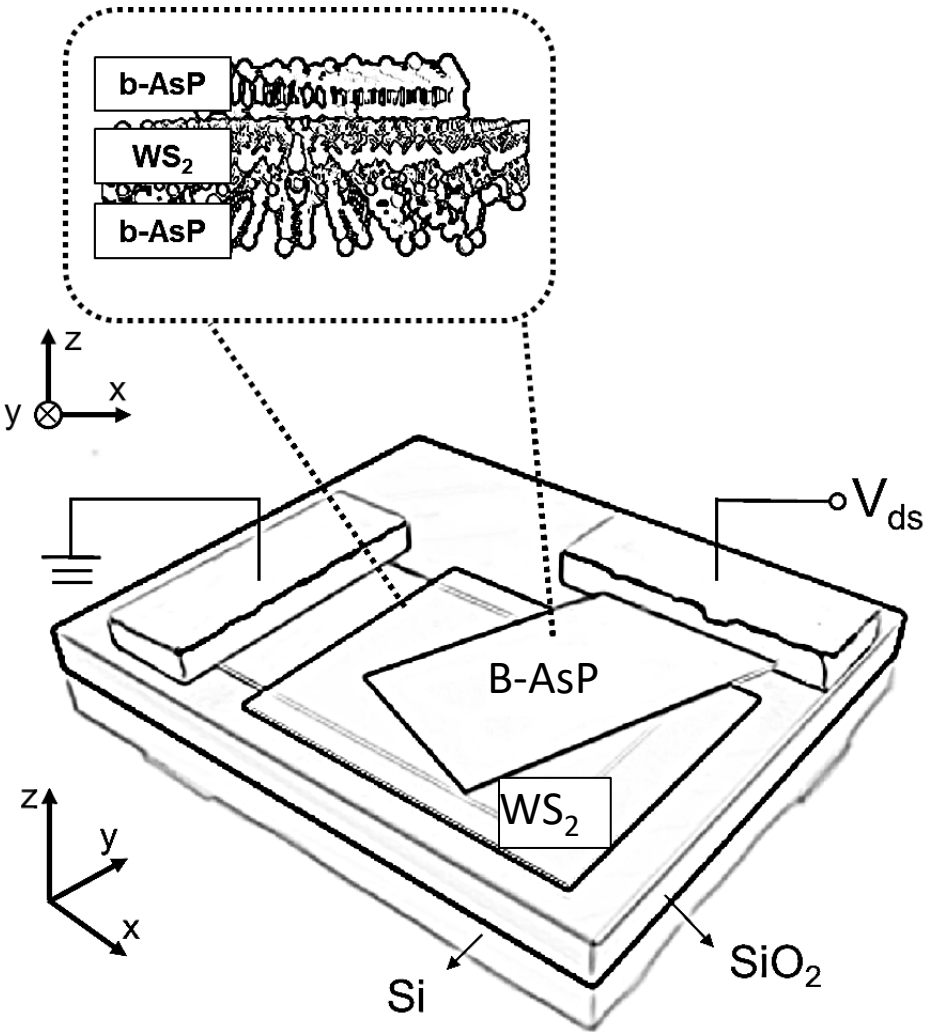


FIG. 3B

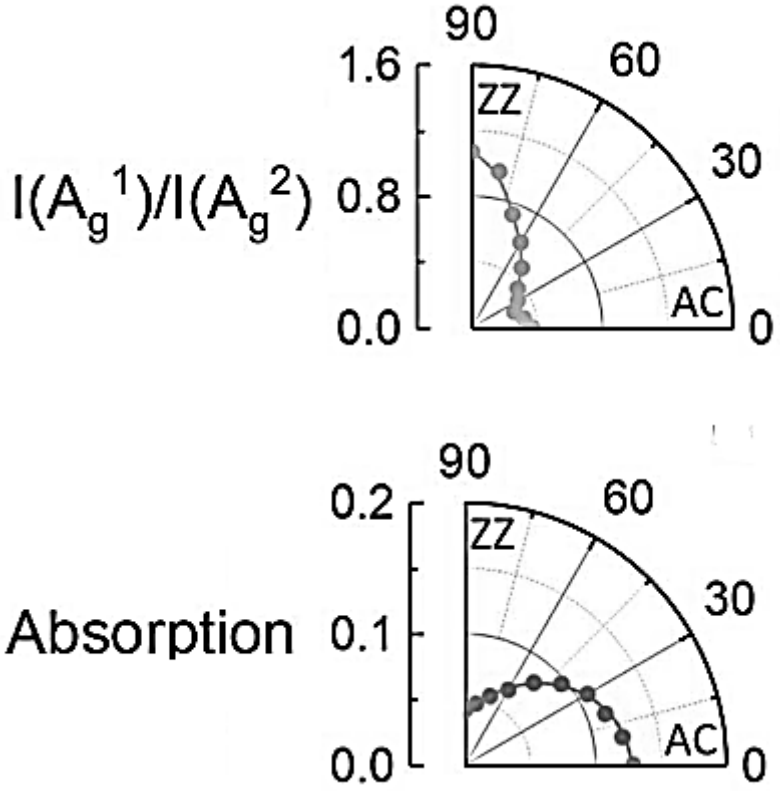

$I(A_g^1)/I(A_g^2)$
1.6
0.8
0.0
90
60
30
0
ZZ
AC
Absorption
0.2
0.1
0.0
90
60
30
0
ZZ
AC

FIG. 3C

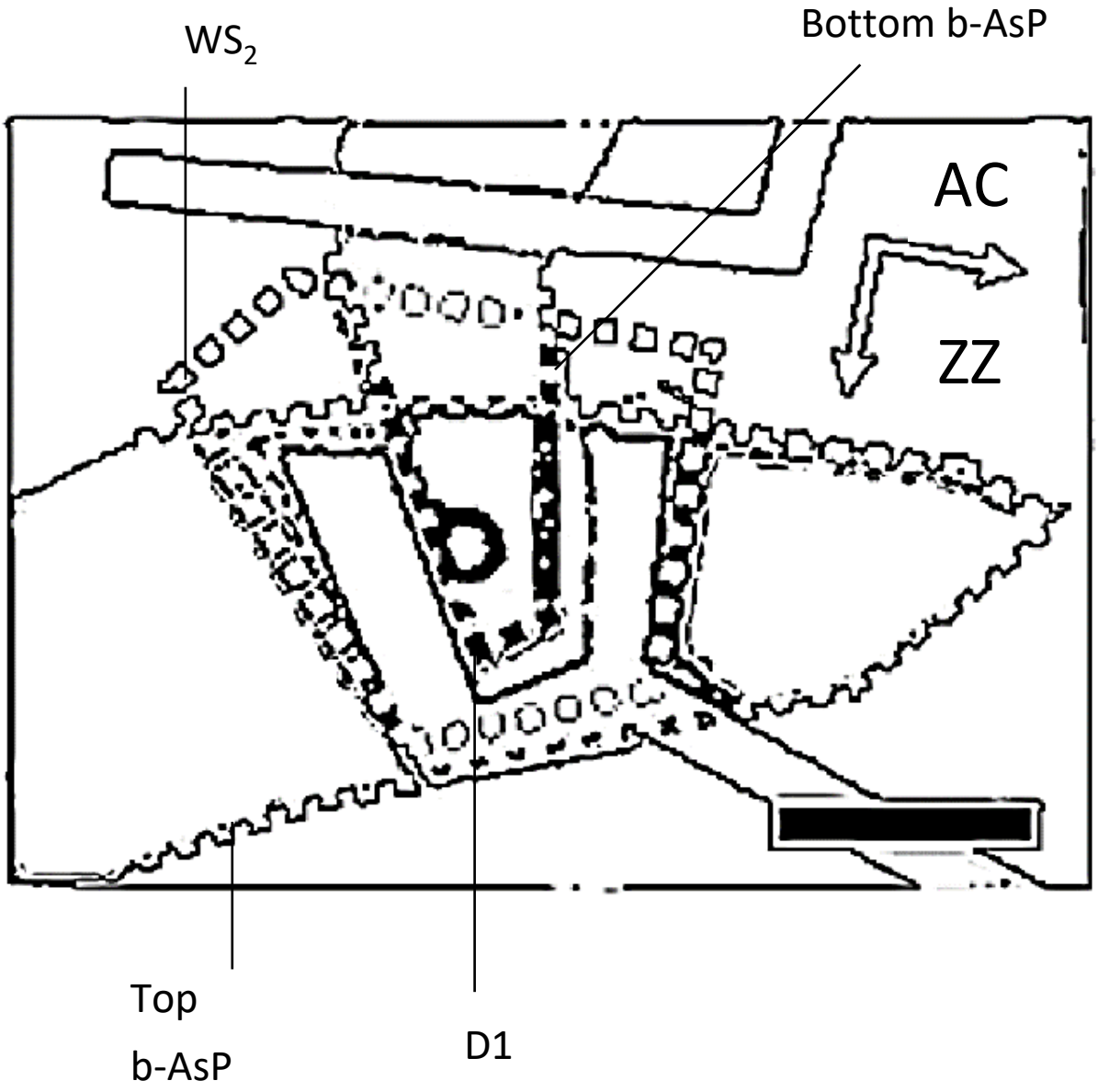


FIG. 3D

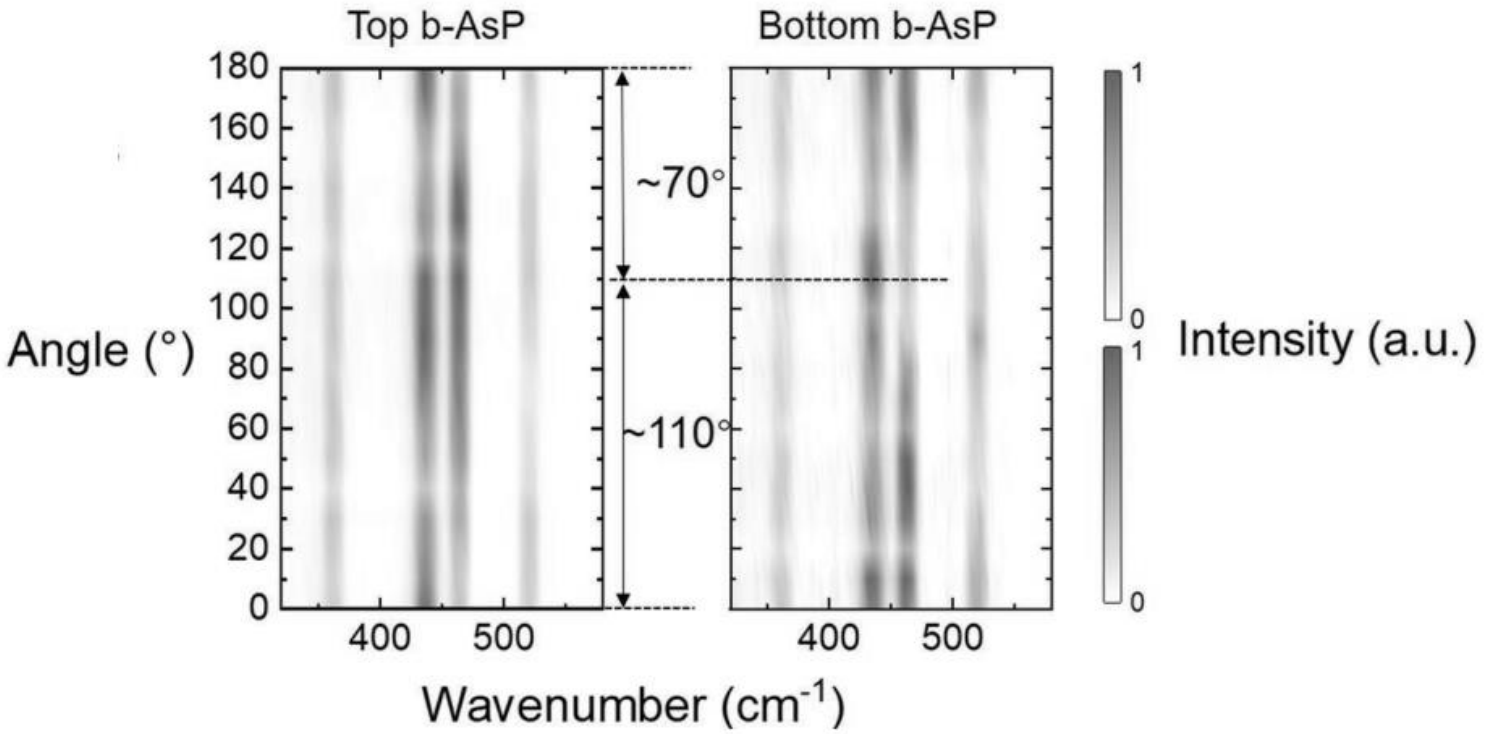

Top b-AsP
Bottom b-AsP
Angle (°)
180
160
140
120
100
80
60
40
20
0
~70°
~110°
400
500
400
500
Wavenumber (cm-1)
1
0
1
0
Intensity (a.u.)

FIG. 4A

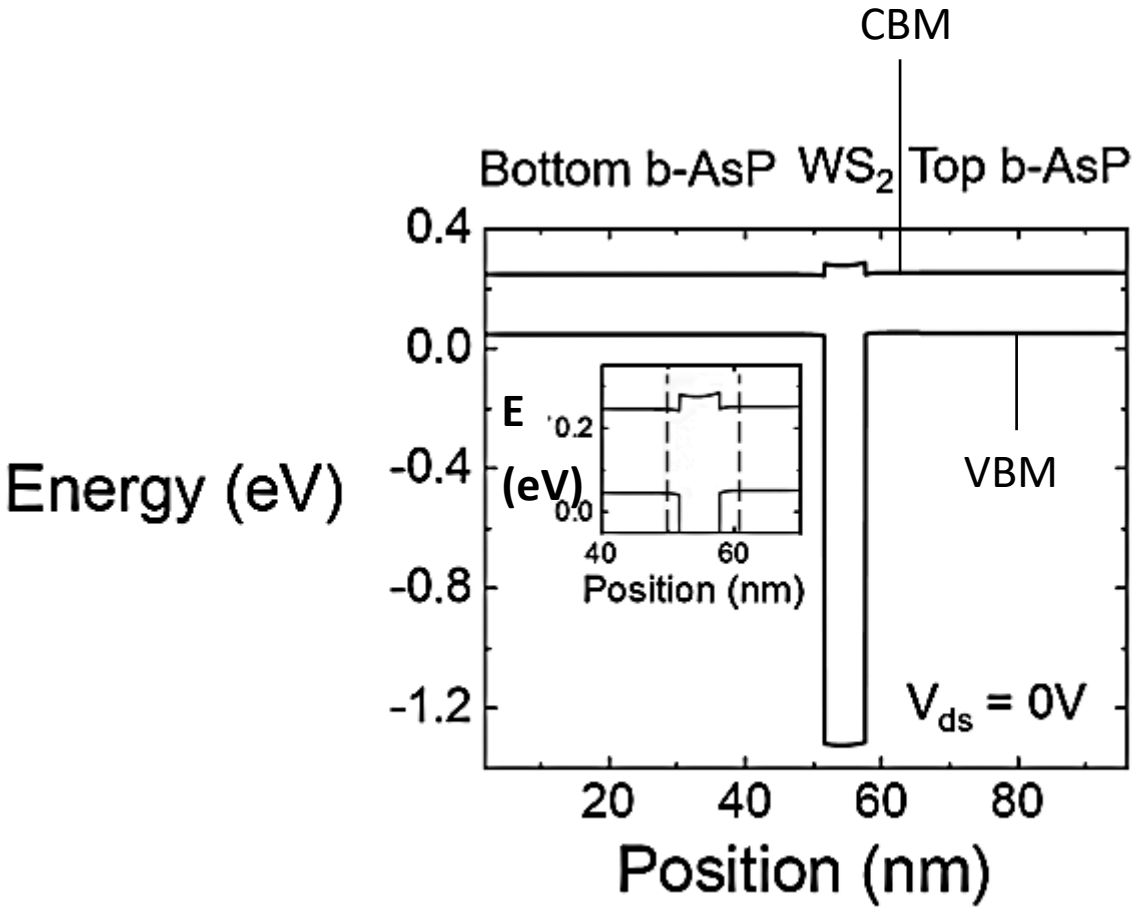

CBM
Bottom b-AsP
WS2
Top b-AsP
VBM
Energy (eV)
0.4
0.0
-0.4
-0.8
-1.2
20
40
60
80
Position (nm)
Vds = 0V
E (eV)
0.2
0.0
40
60
Position (nm)

FIG. 4B

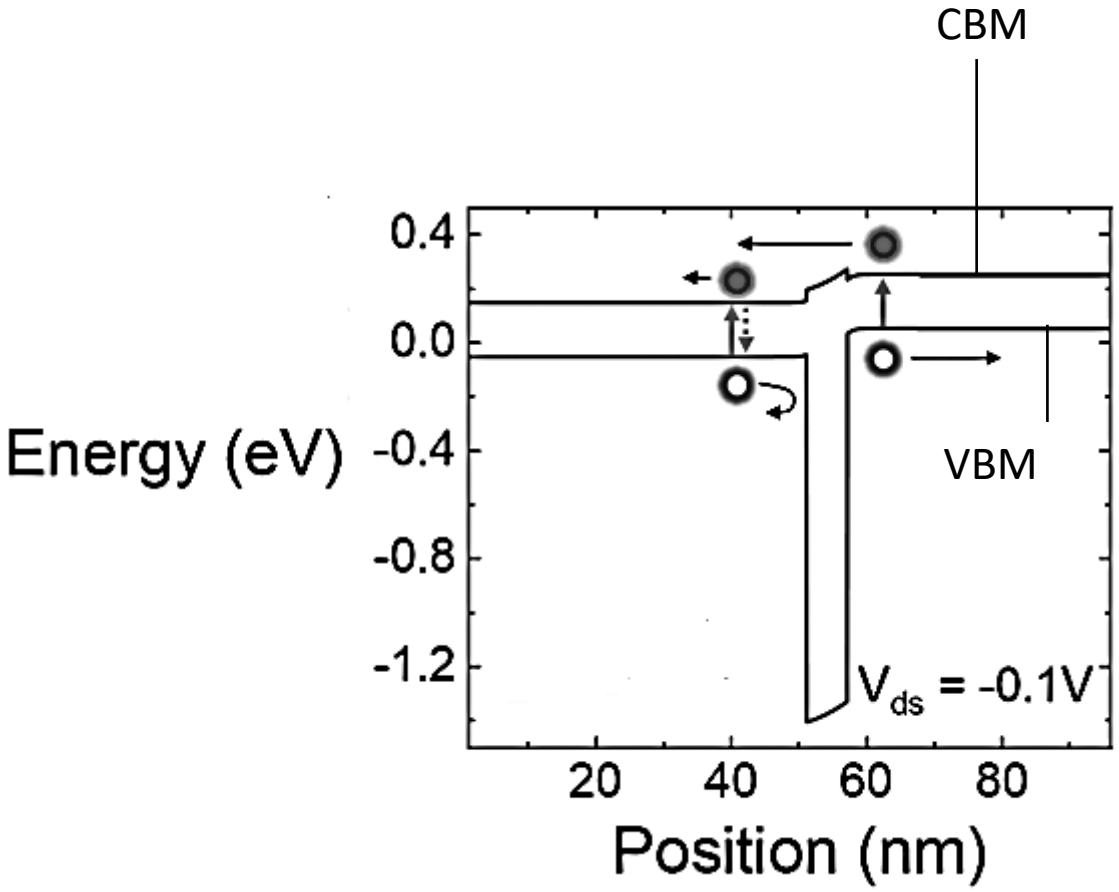


FIG. 4C

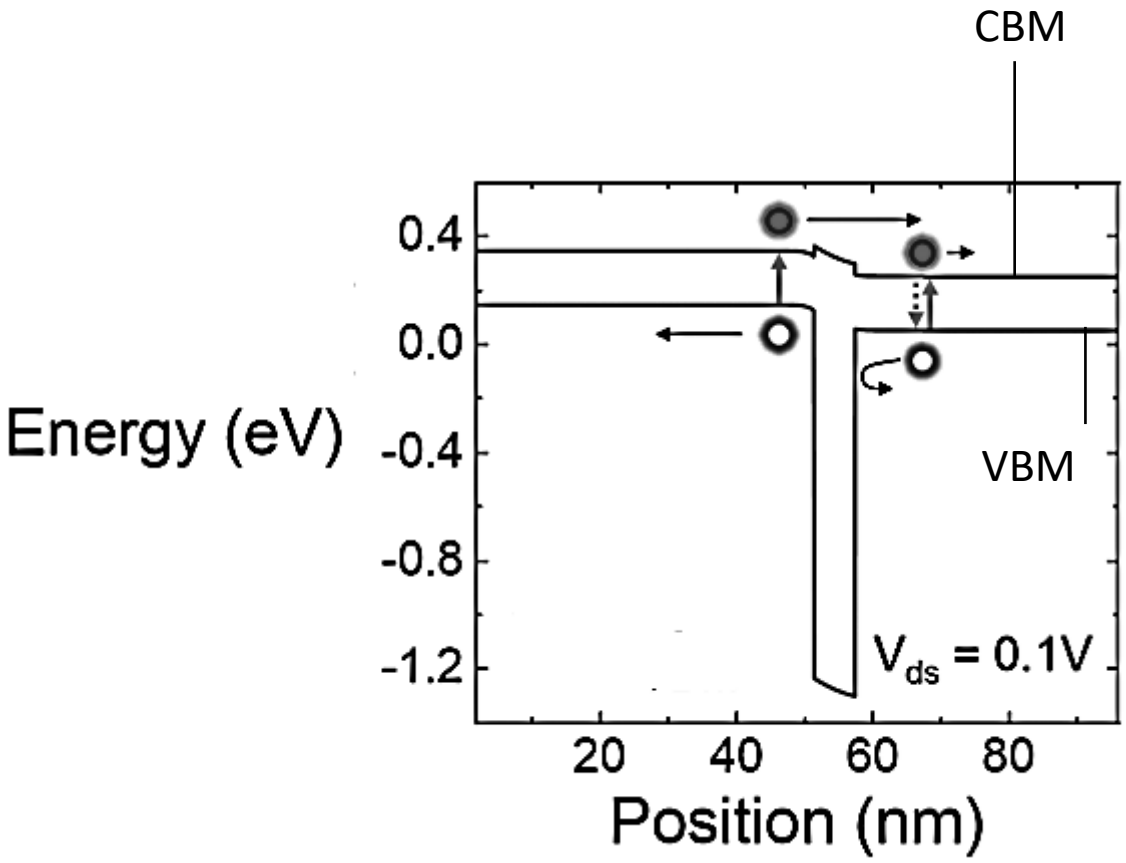


FIG. 4D

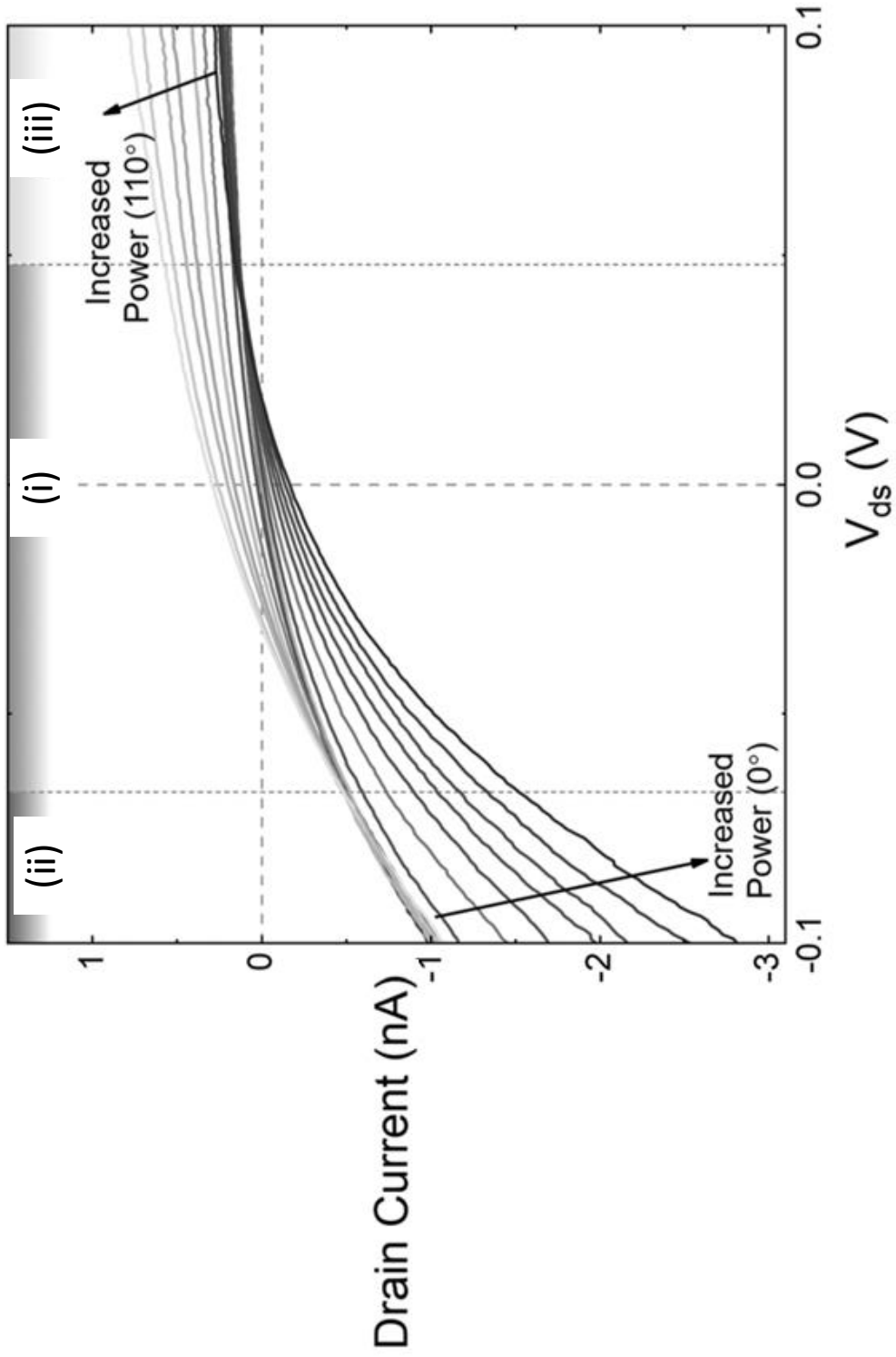

(ii)
(i)
(iii)
Increased Power (110°)
Increased Power (0°)
Drain Current (nA)
1
0
-1
-2
-3
-0.1
0.0
0.1
V_{ds} (V)

FIG. 4E

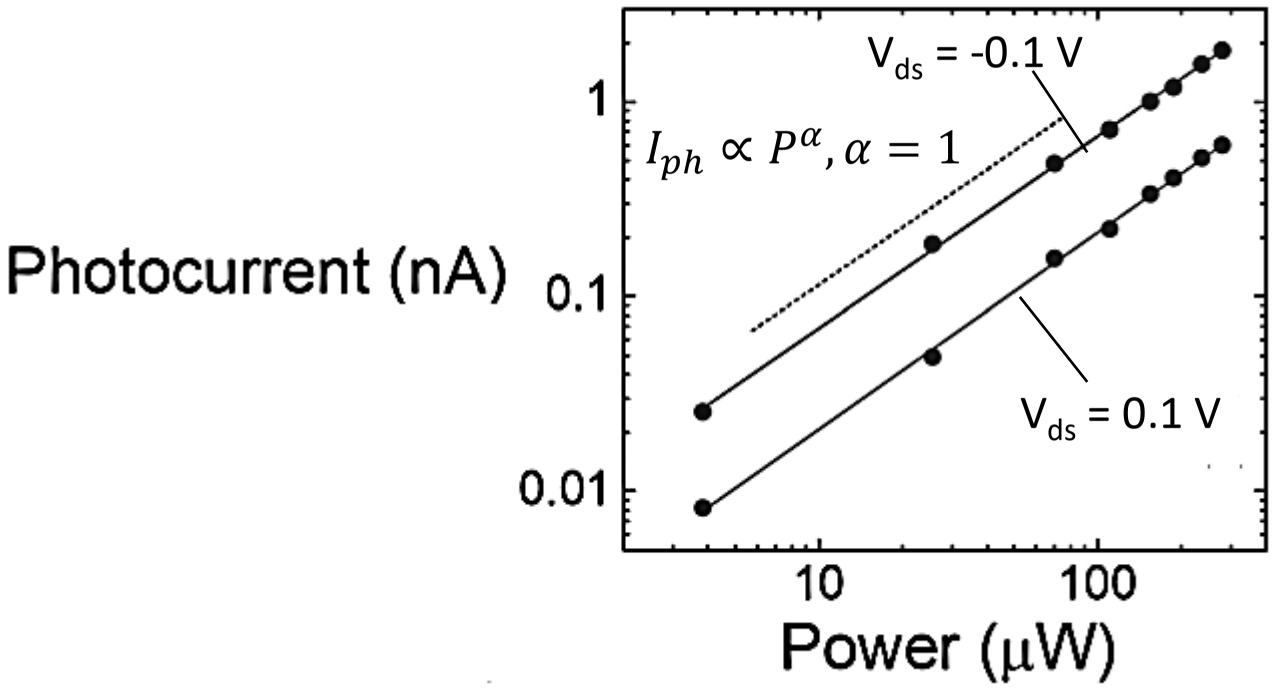

Photocurrent (nA)
1
0.1
0.01
10
100
Power (μW)
V_{ds} = -0.1 V
$I_{ph} \propto P^{\alpha}, \alpha = 1$
V_{ds} = 0.1 V

FIG. 4F

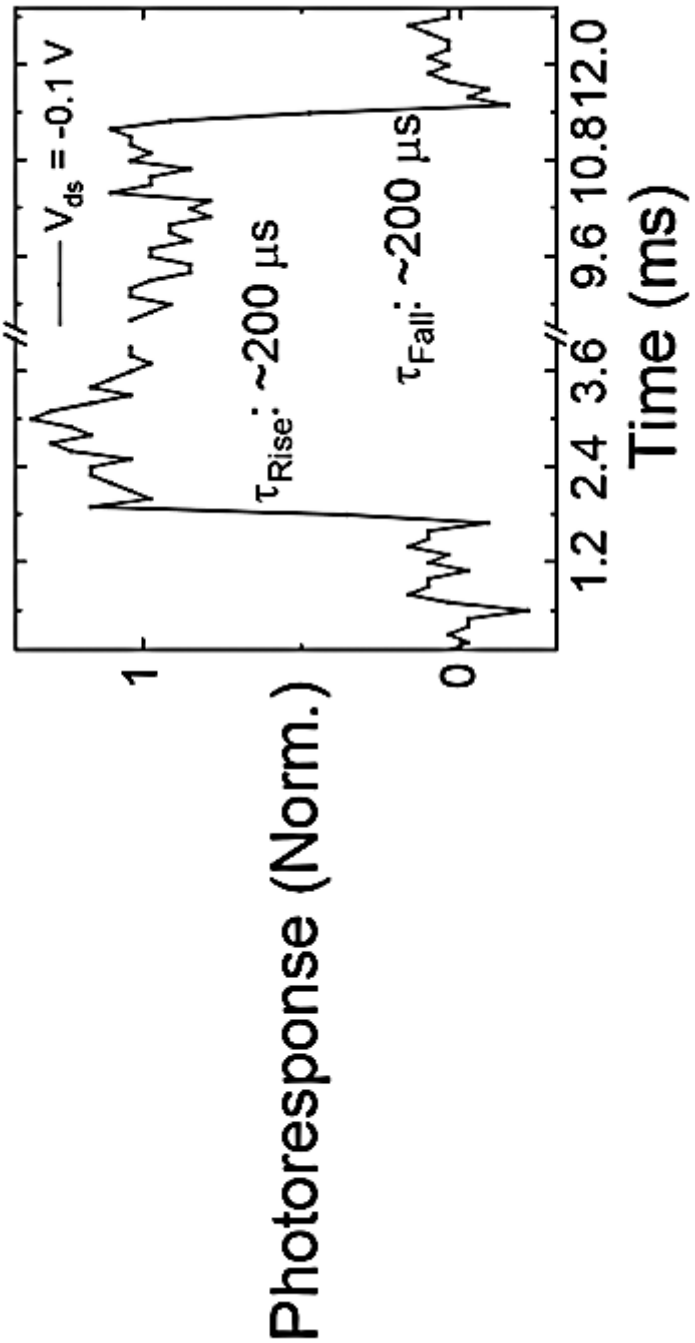

Photoresponse (Norm.)
Time (ms)
V_{ds} = -0.1 V
τ_{Rise}: ~200 µs
τ_{Fall}: ~200 µs
0
1
1.2
2.4
3.6
9.6
10.8
12.0

FIG. 5A

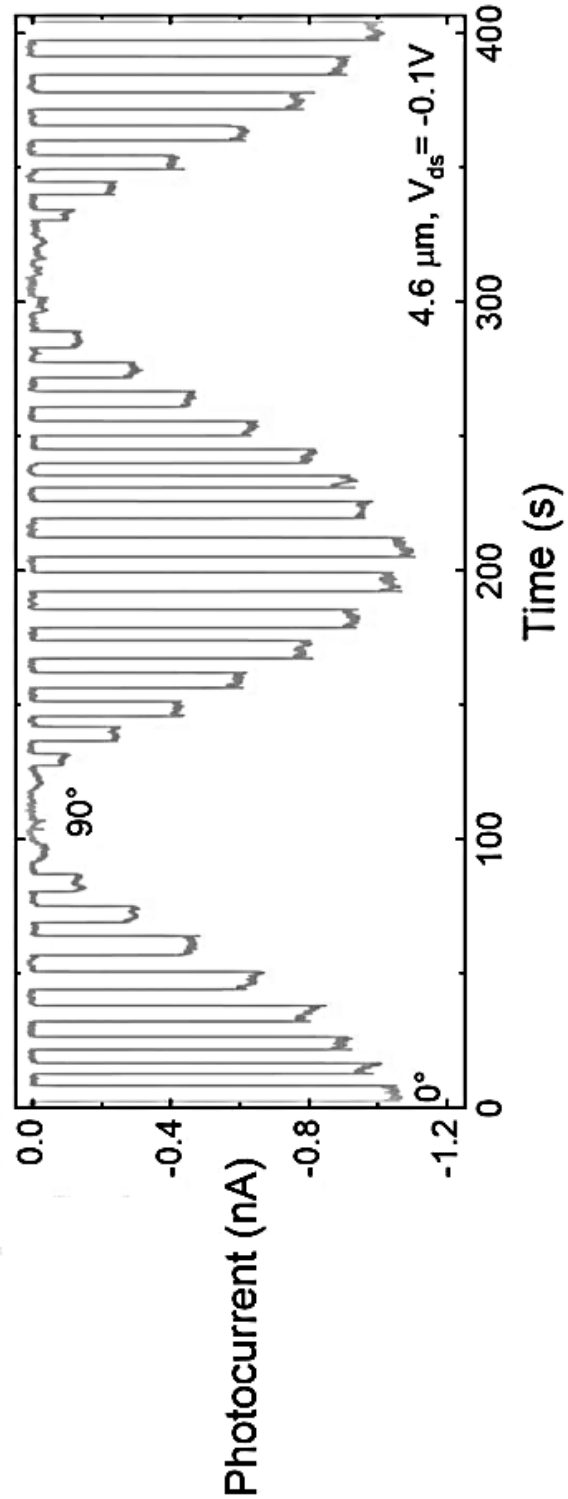

0.0
-0.4
-0.8
-1.2
Photocurrent (nA)
0
100
200
300
400
Time (s)
90°
0°
4.6 μm, V_{ds} = -0.1V

FIG. 5B

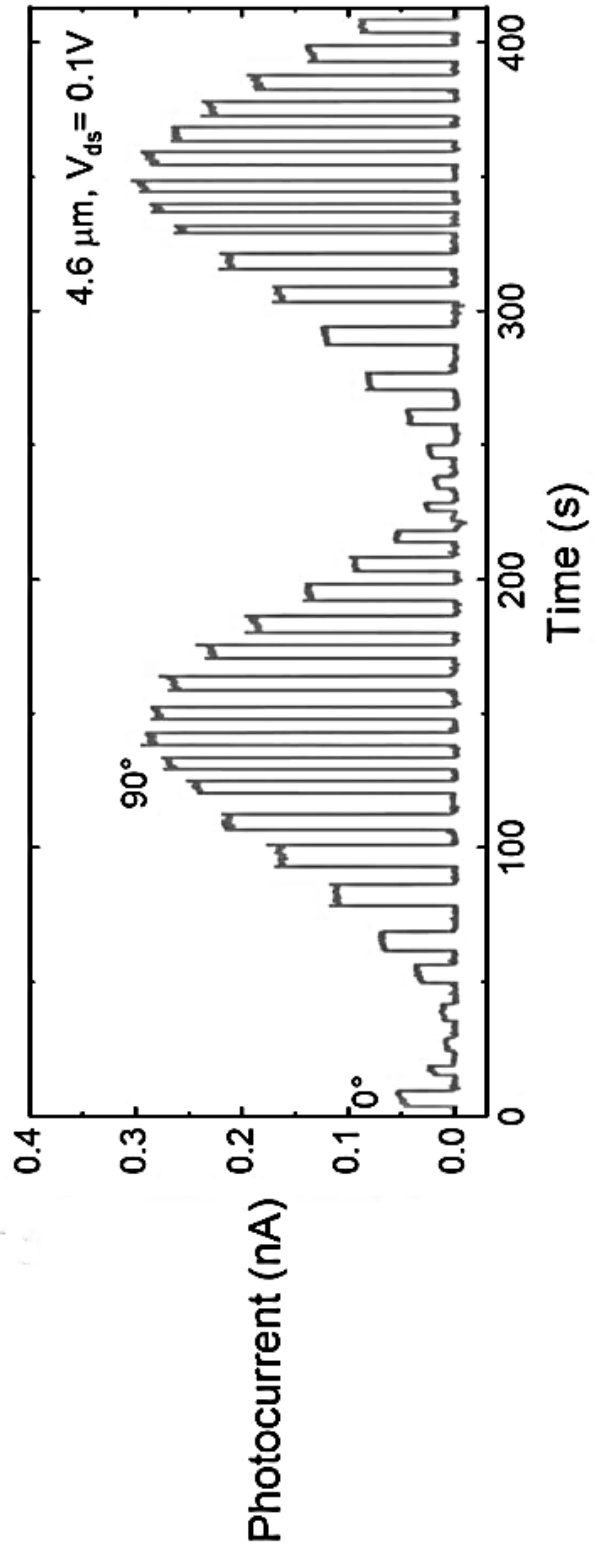

4.6 μm, V_{ds}= 0.1V
90°
0°
Photocurrent (nA)
Time (s)
0.4
0.3
0.2
0.1
0.0
0
100
200
300
400

FIG. 5C

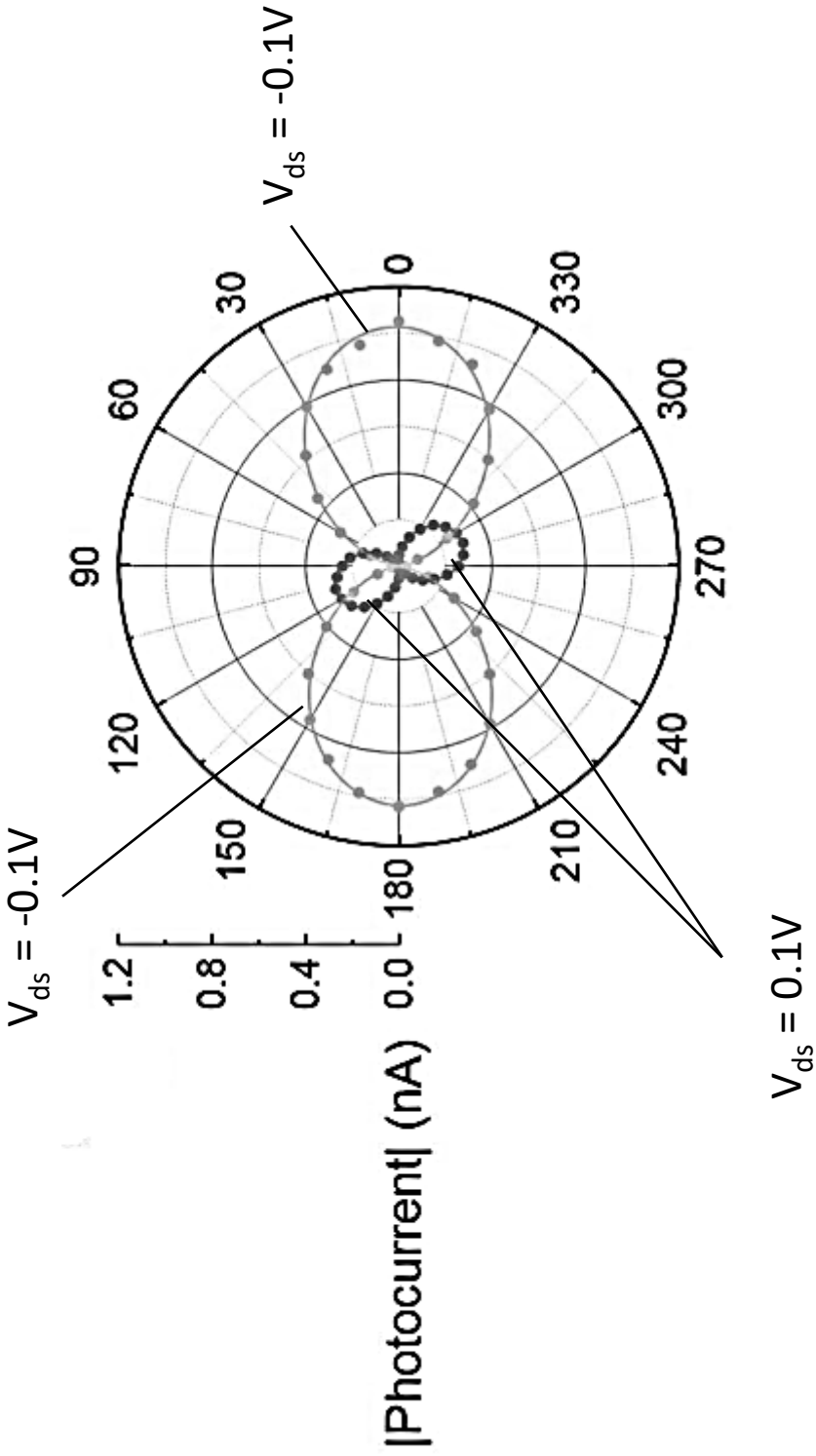

V_{ds} = -0.1V
V_{ds} = -0.1V
V_{ds} = 0.1V
0
30
60
90
120
150
180
210
240
270
300
330
1.2
0.8
0.4
0.0
|Photocurrent| (nA)

FIG. 5D

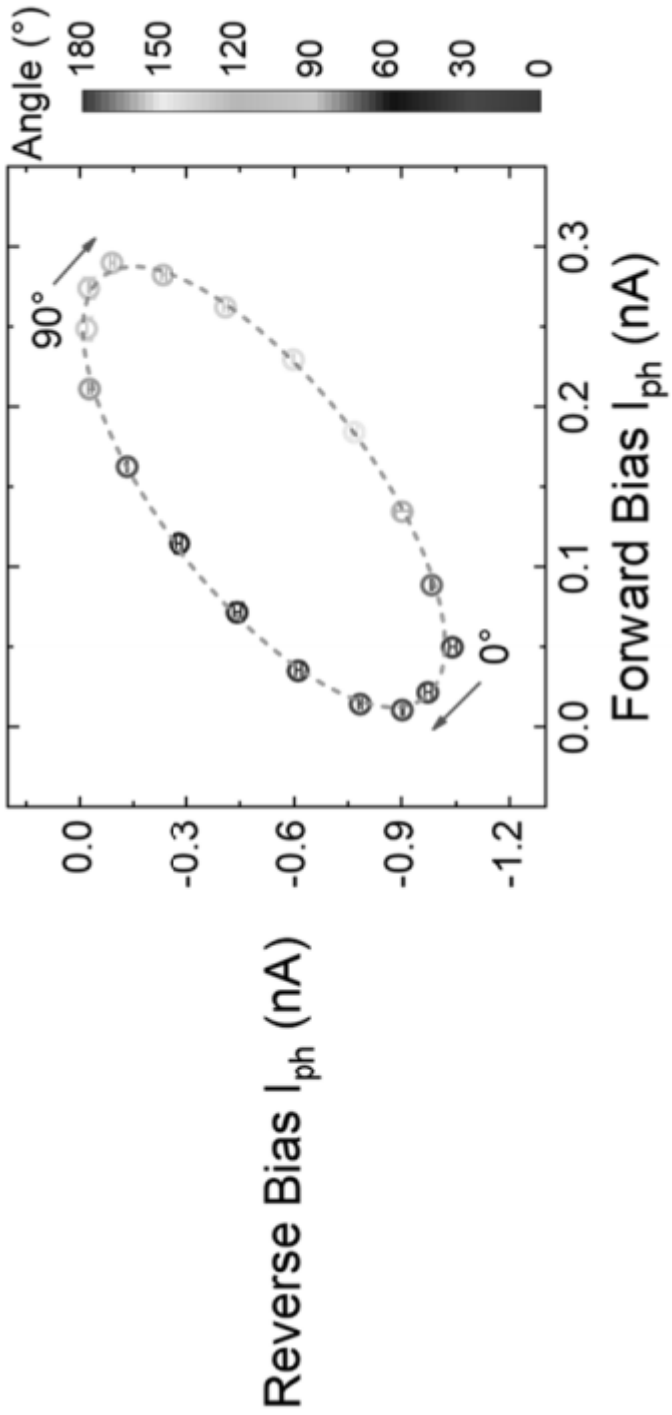

Angle (°)
180
150
120
90
60
30
0
90°
0°
0.0
0.1
0.2
0.3
Forward Bias I_{ph} (nA)
0.0
-0.3
-0.6
-0.9
-1.2
Reverse Bias I_{ph} (nA)

FIG. 6A

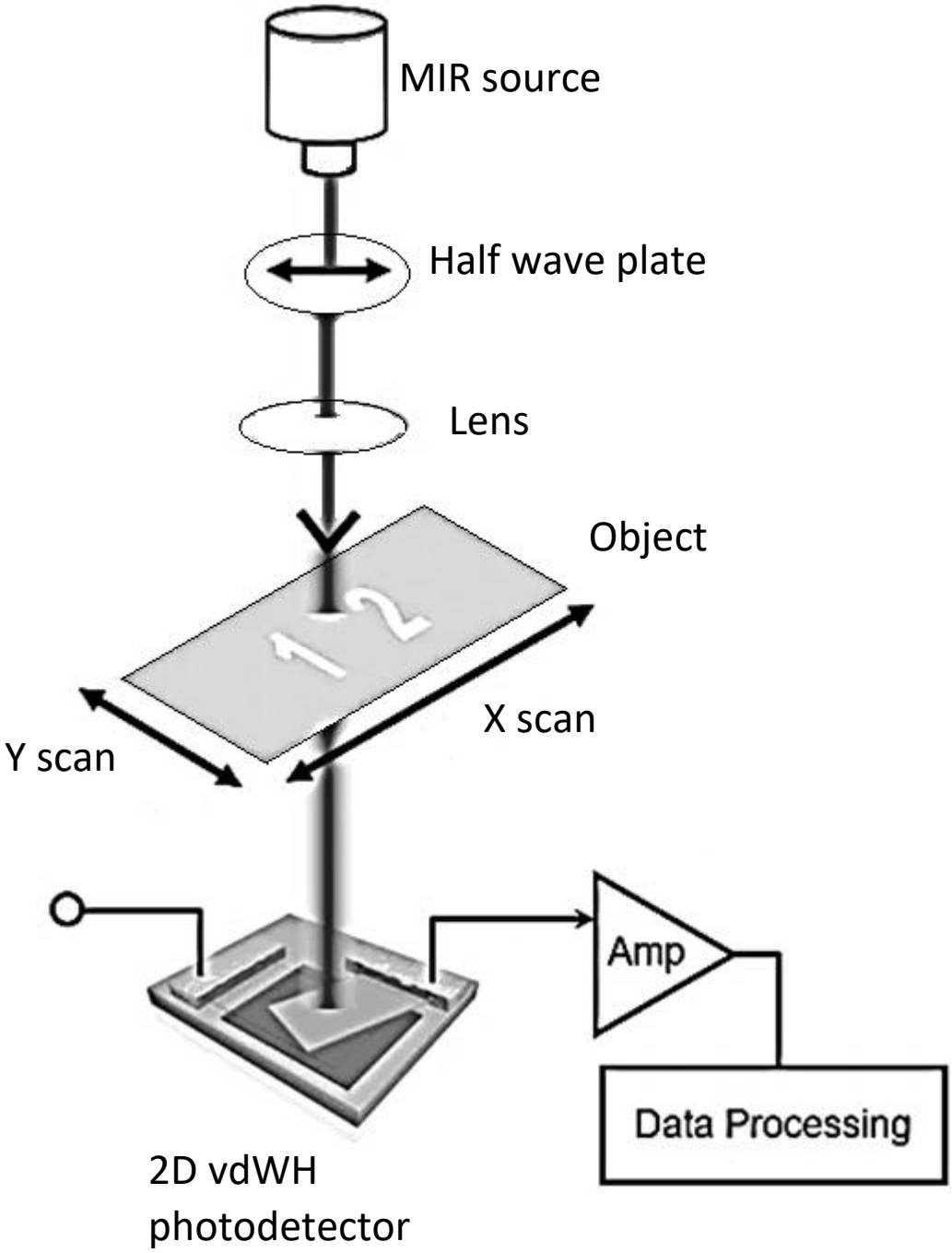

MIR source
Half wave plate
Lens
Object
1 2
X scan
Y scan
Amp
Data Processing
2D vdWH
photodetector

FIG. 6B

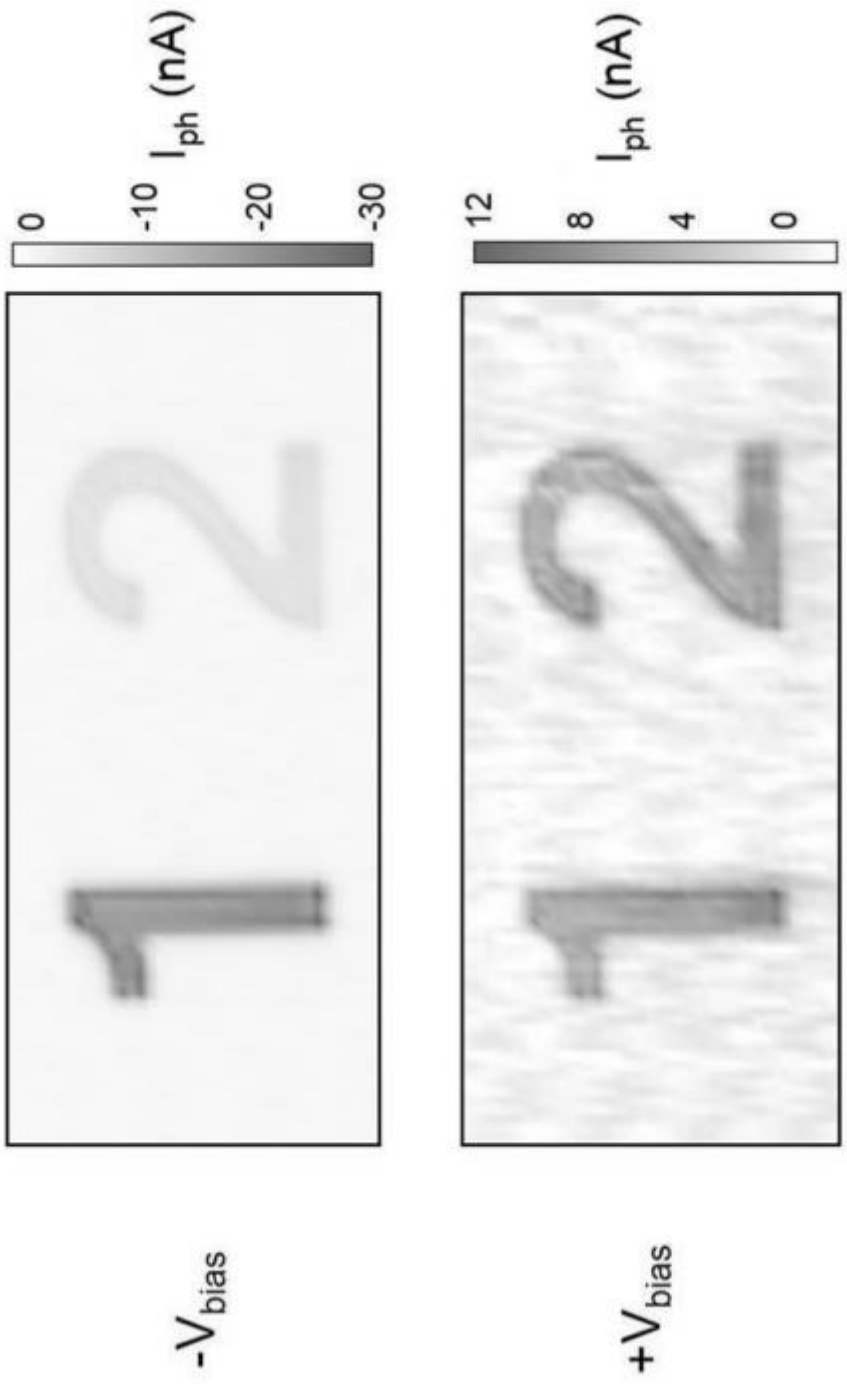


FIG. 6C



FIG. 7A

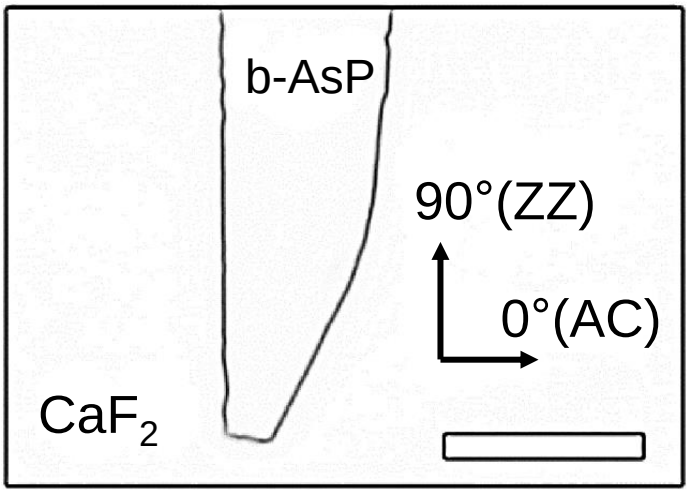


FIG. 7B

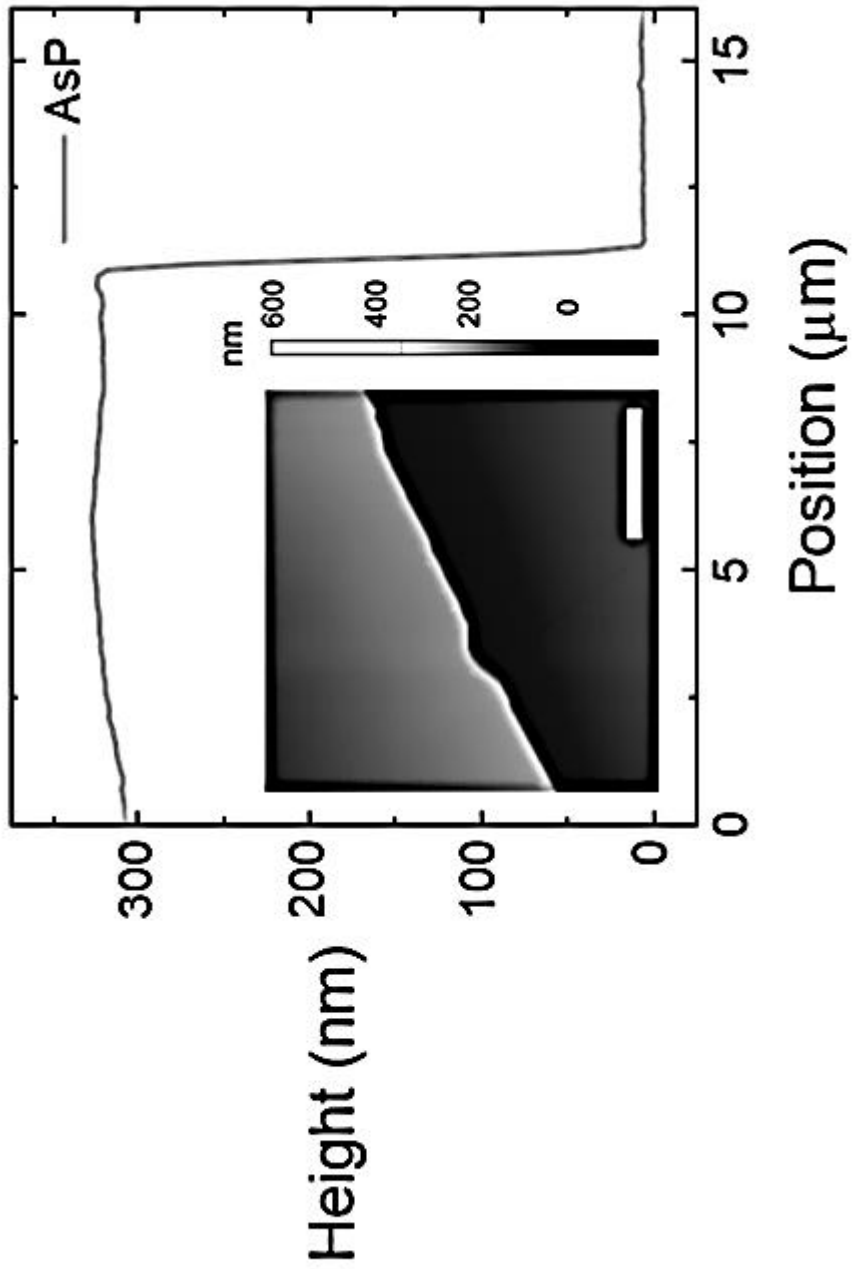


FIG. 7C

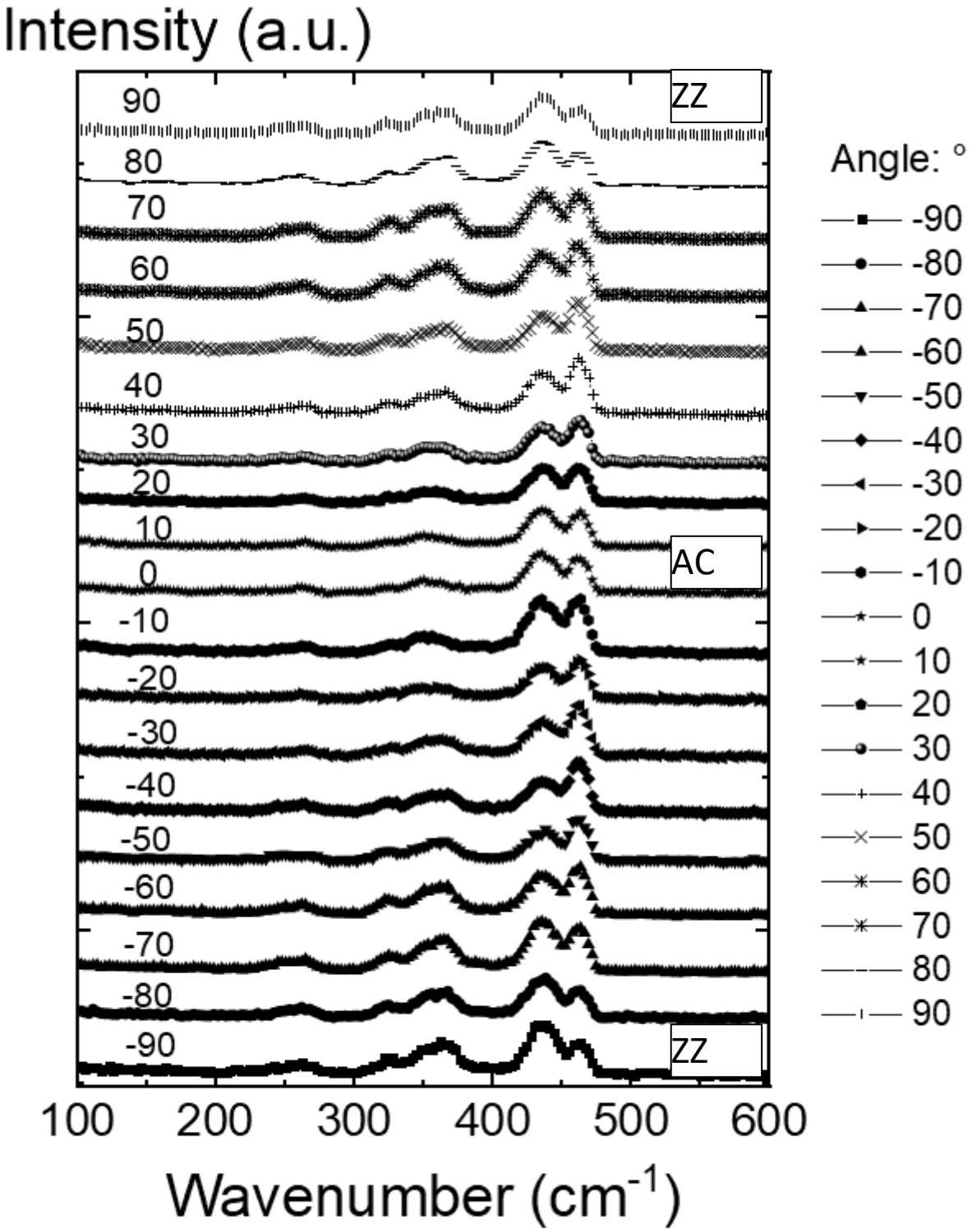

Intensity (a.u.)
ZZ
AC
ZZ
90
80
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
Angle: °
-90
-80
-70
-60
-50
-40
-30
-20
-10
0
10
20
30
40
50
60
70
80
90
100
200
300
400
500
600
Wavenumber (cm-1)

FIG. 7D

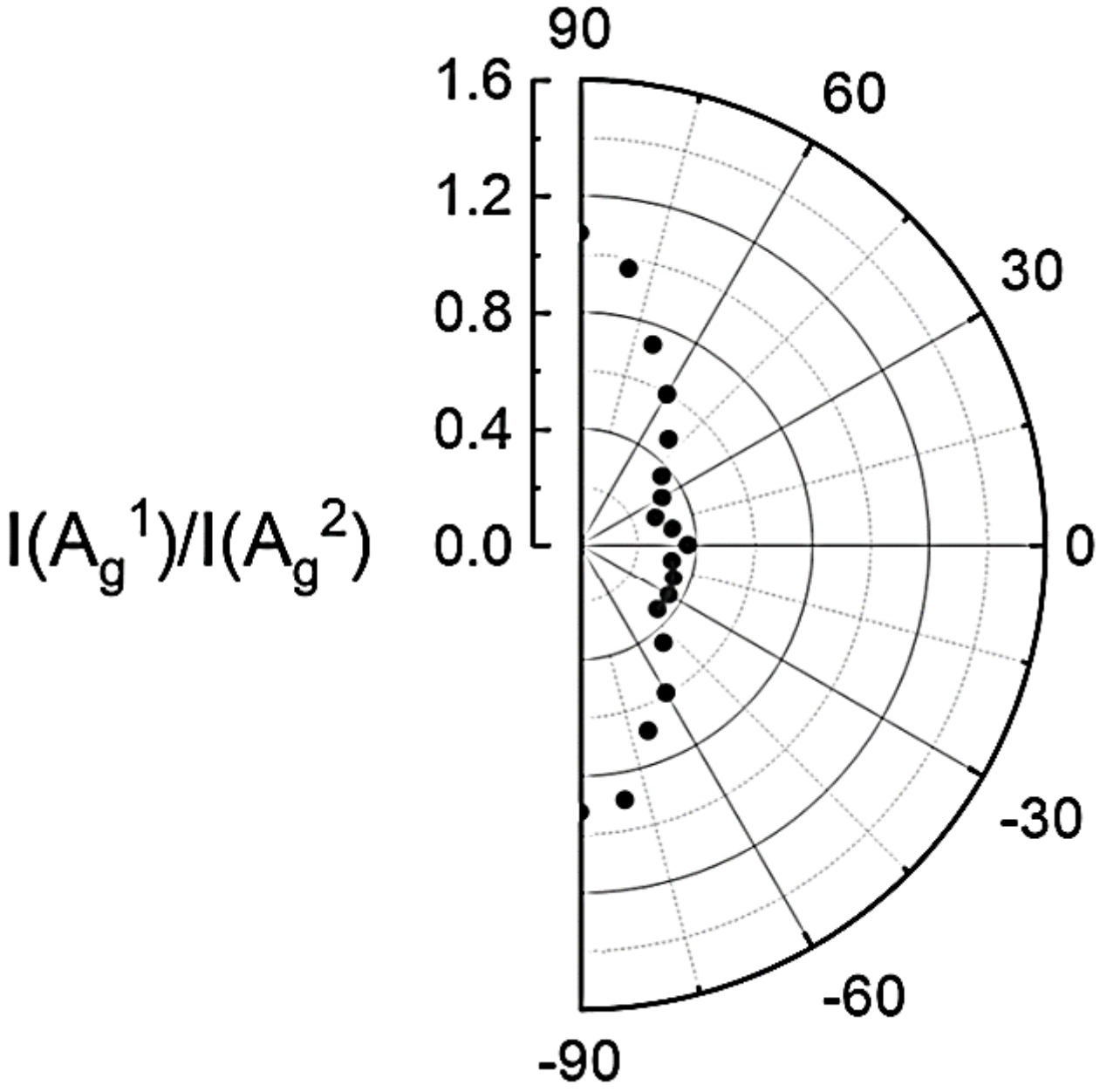


FIG. 8A

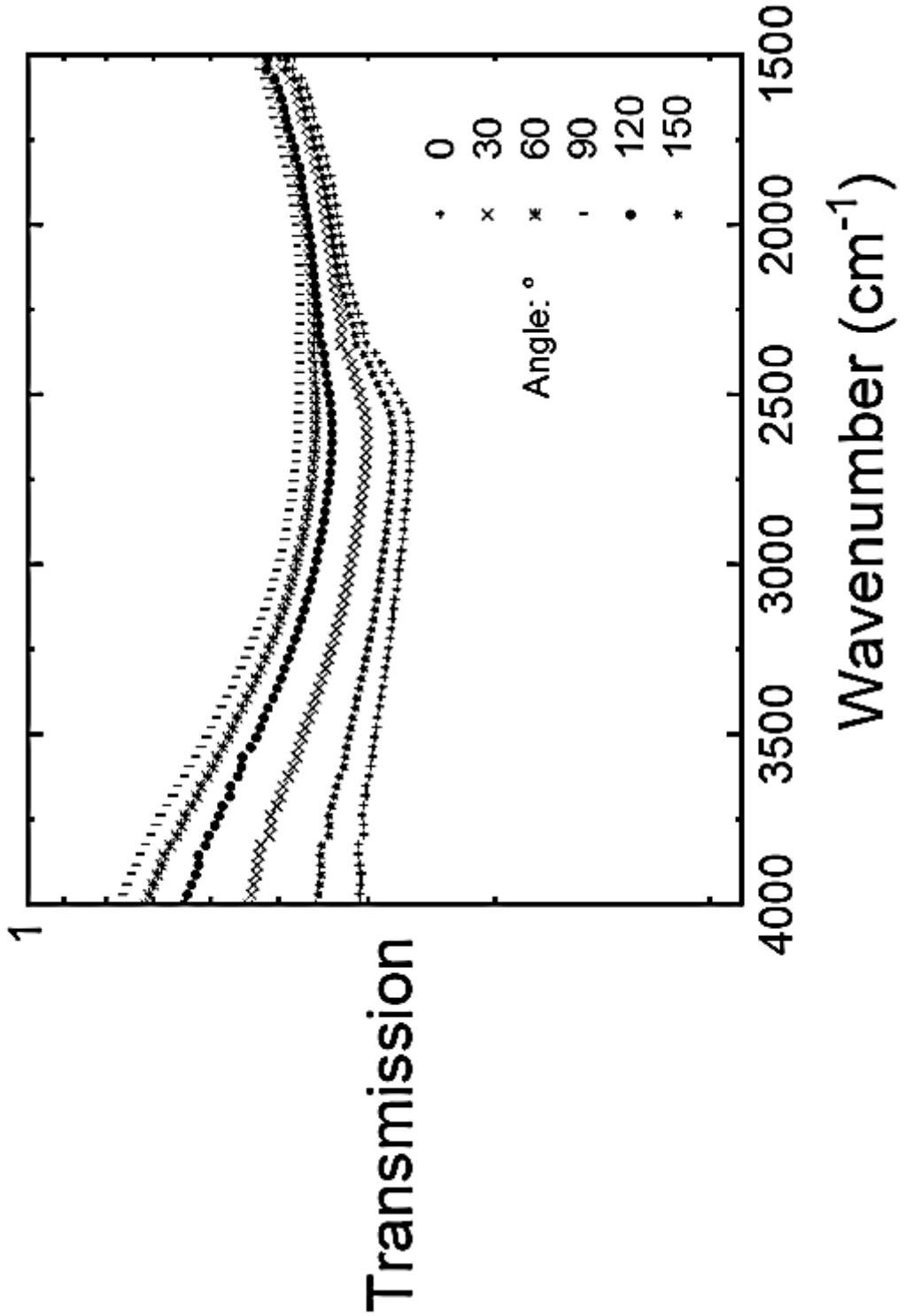

Transmission
1
4000
3500
3000
2500
2000
1500
Wavenumber (cm-1)
Angle: °
0
30
60
90
120
150

FIG. 8B

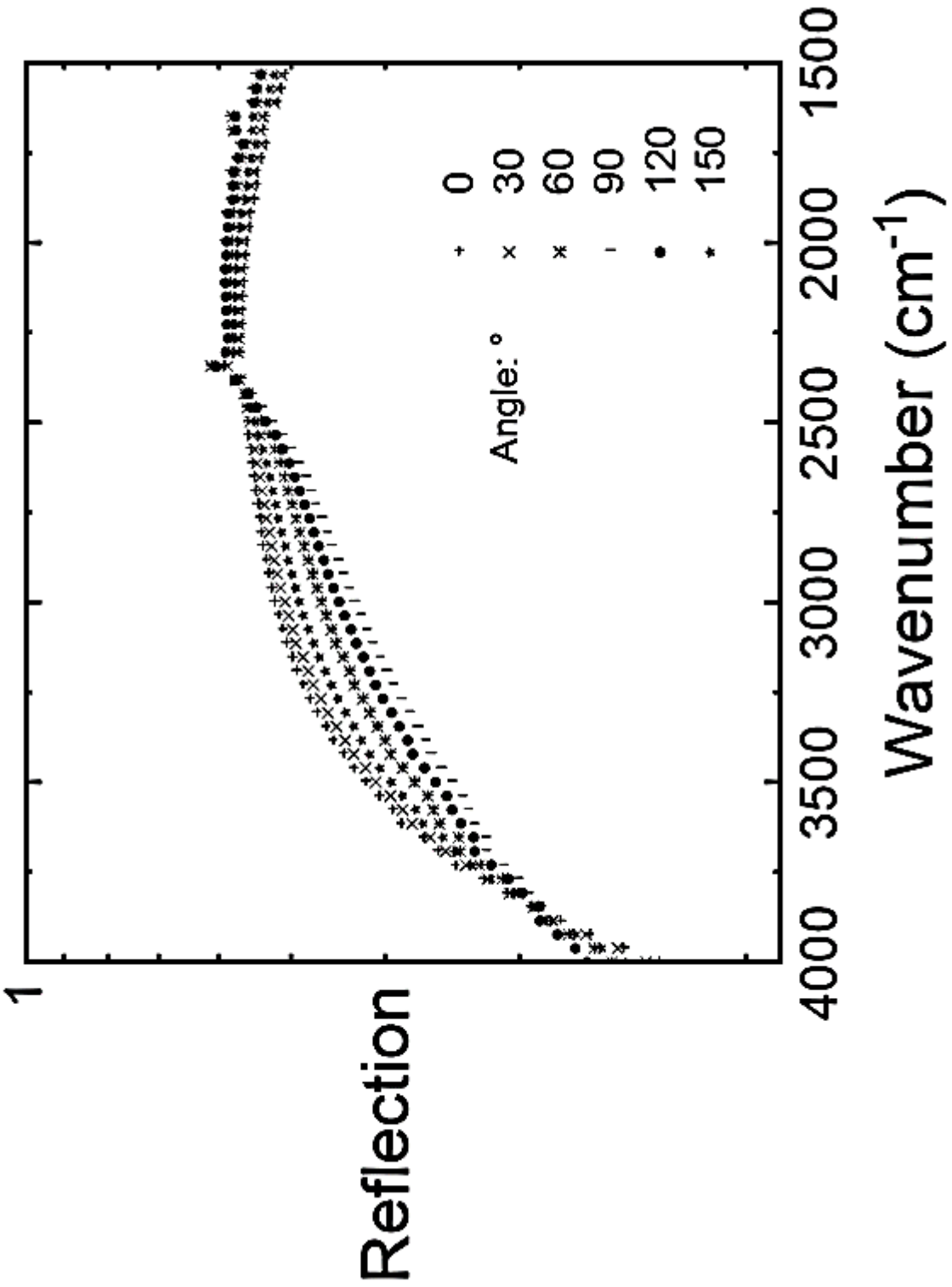

Reflection
1
4000
3500
3000
2500
2000
1500
Wavenumber (cm-1)
Angle: °
0
30
60
90
120
150

FIG. 8C

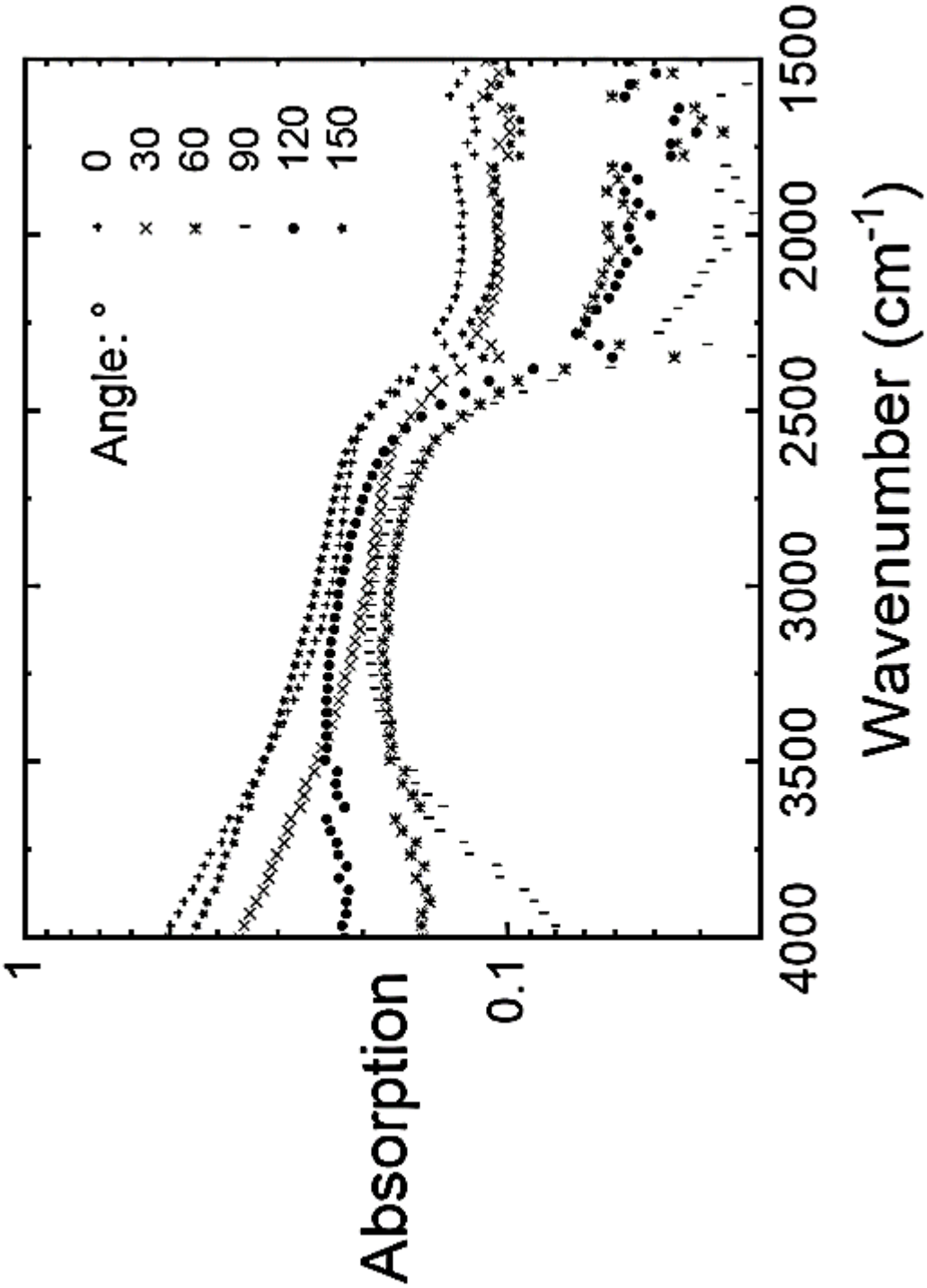

Angle: °
0
30
60
90
120
150
Absorption
1
0.1
4000
3500
3000
2500
2000
1500
Wavenumber (cm-1)

FIG. 9A

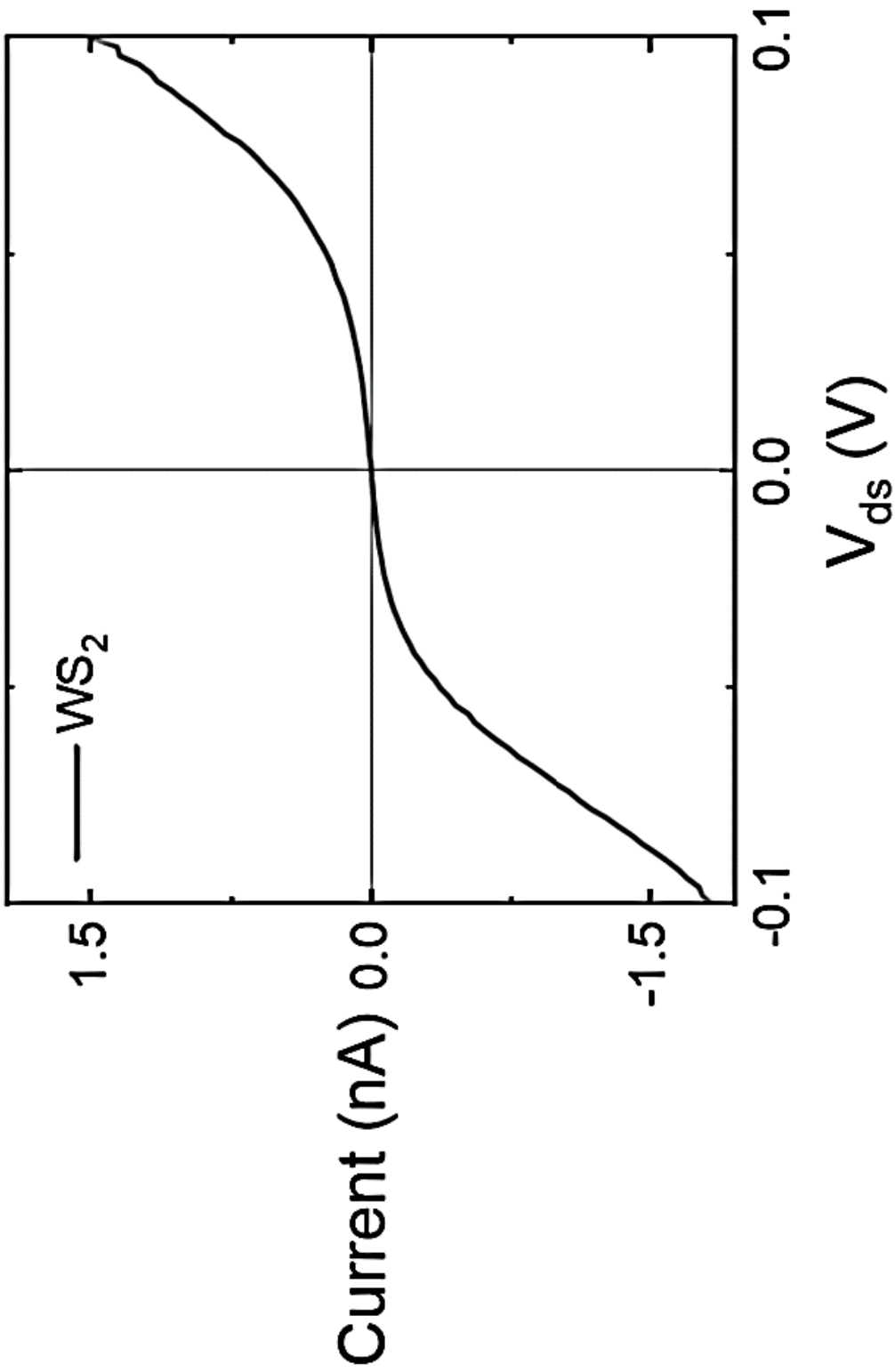


FIG. 9B

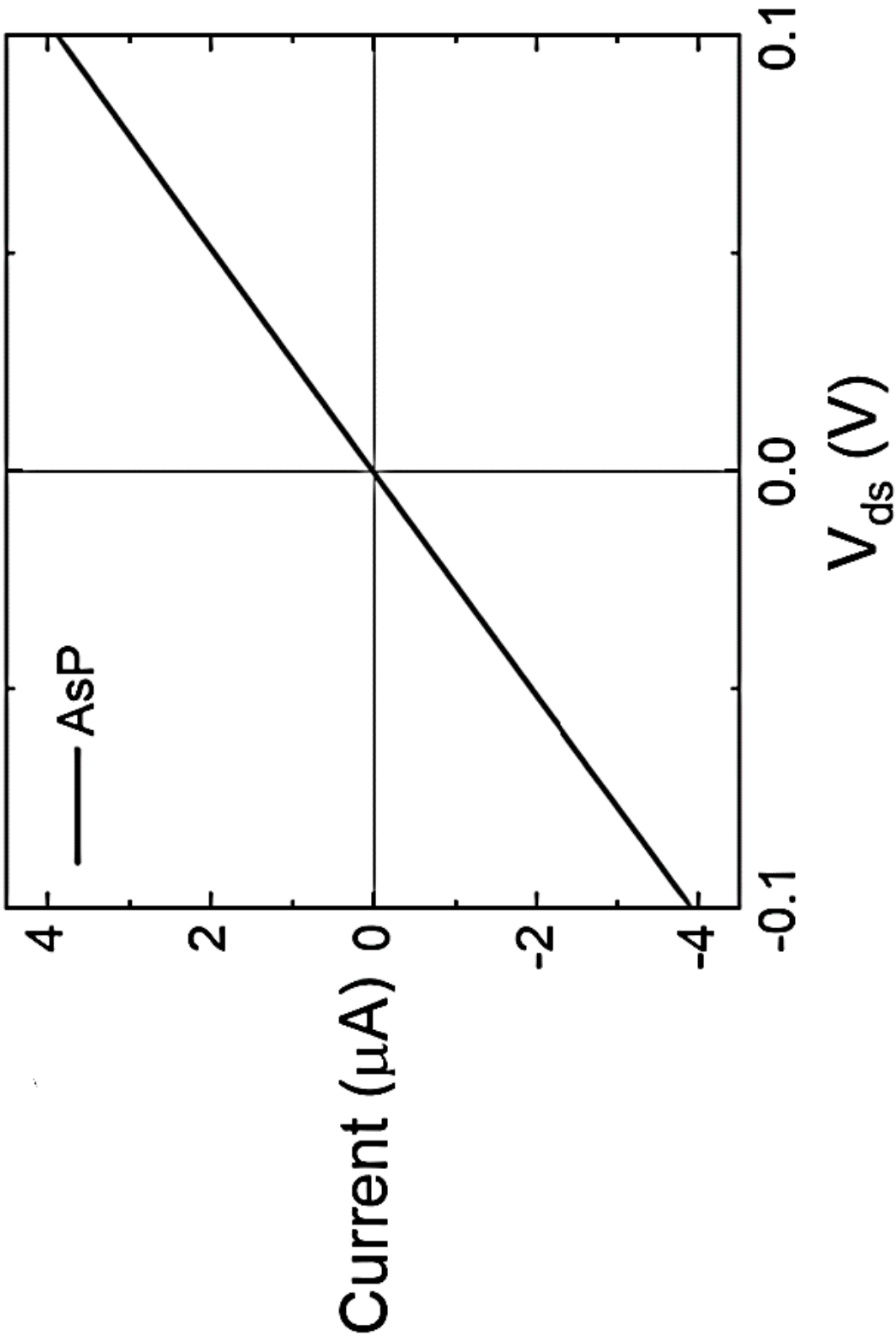


FIG. 9C

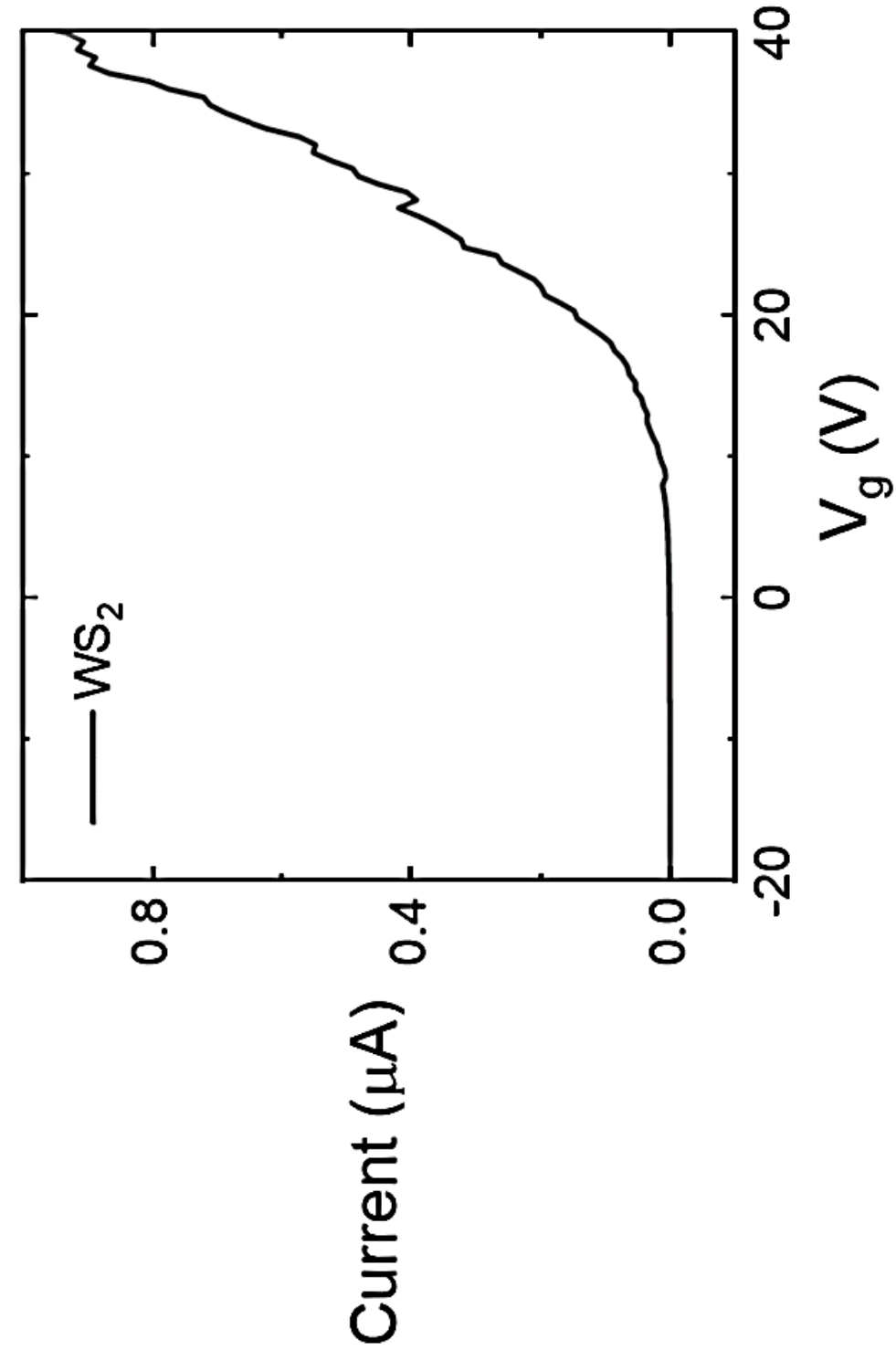


FIG. 9D

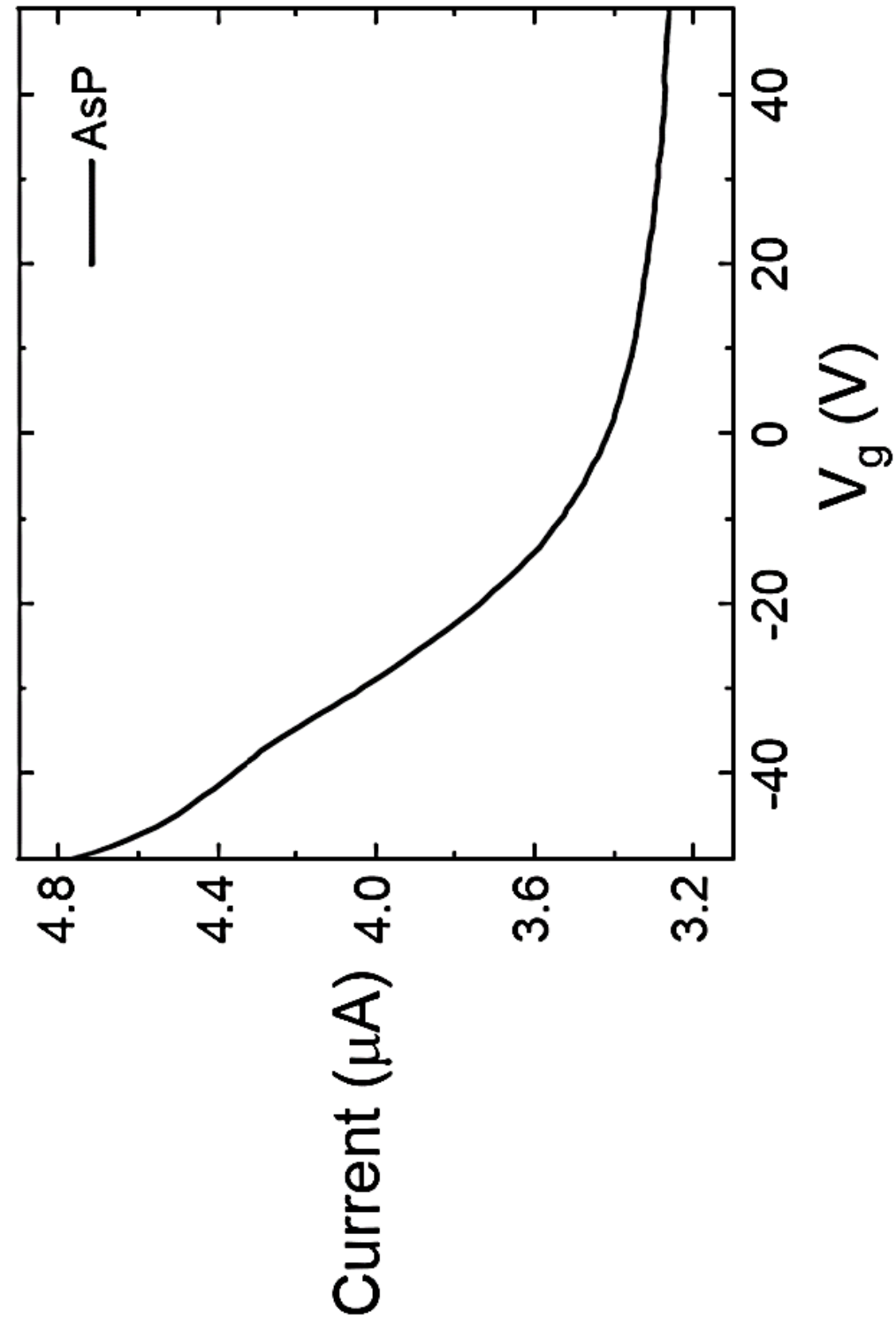


FIG. 10A

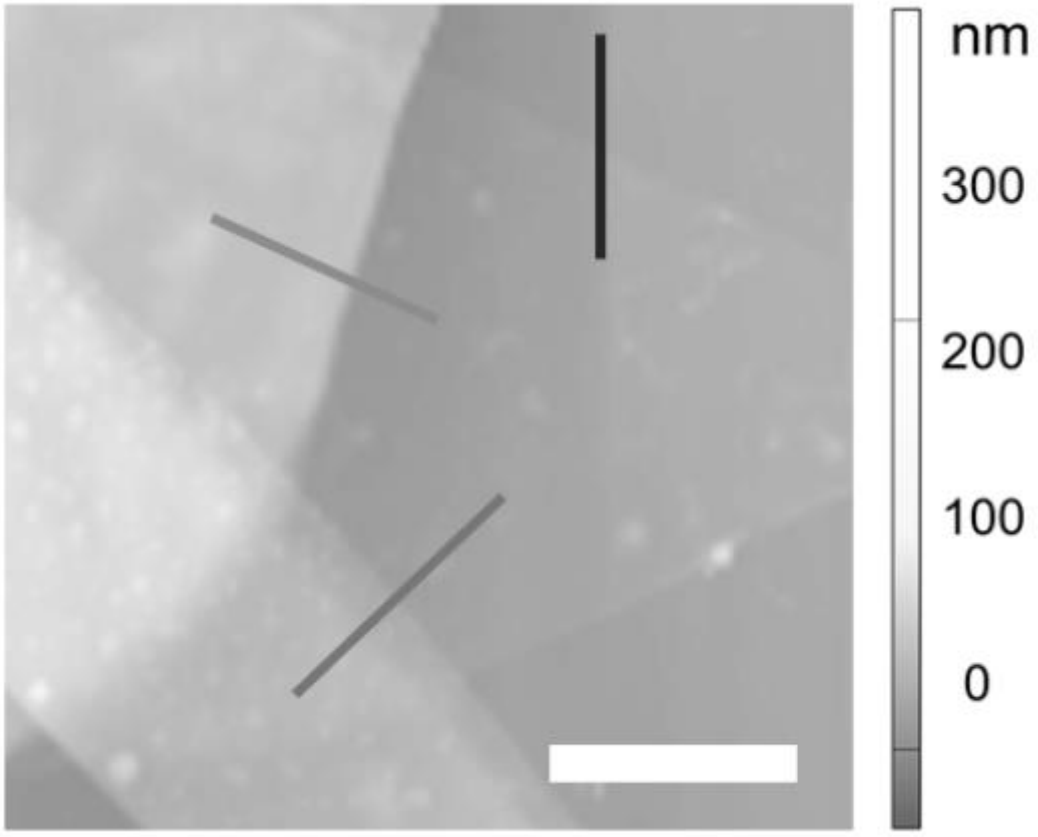


FIG. 10B

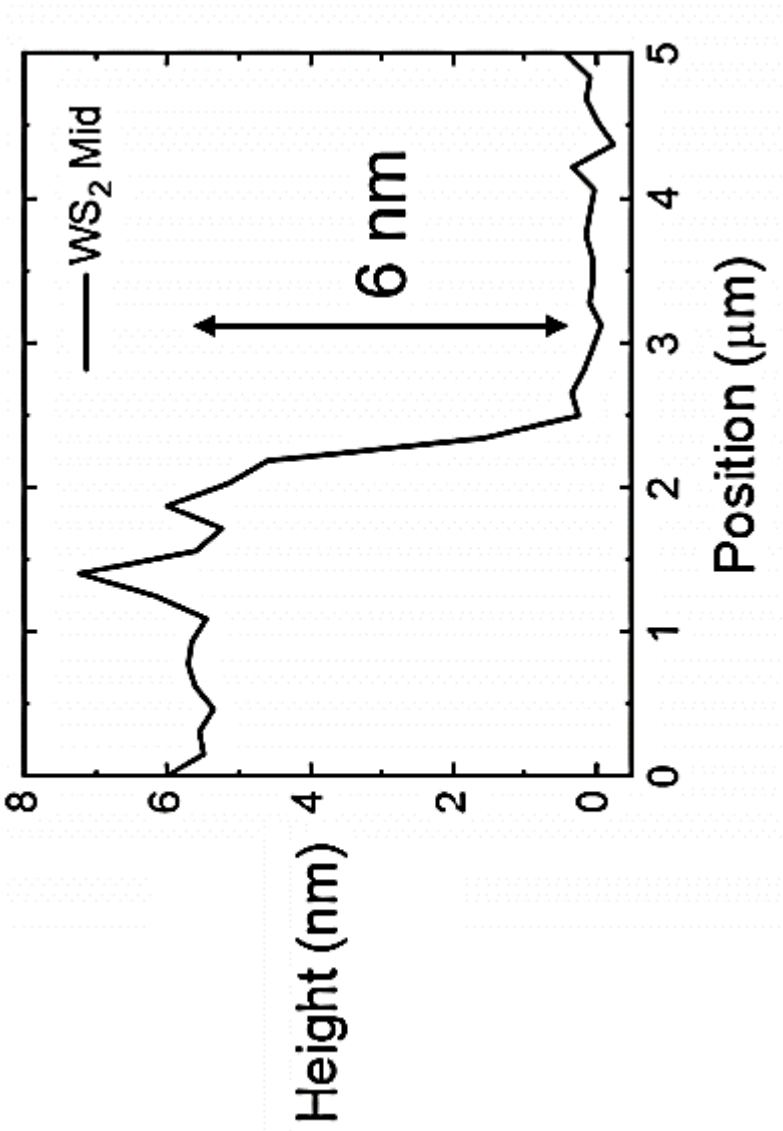


FIG. 10C

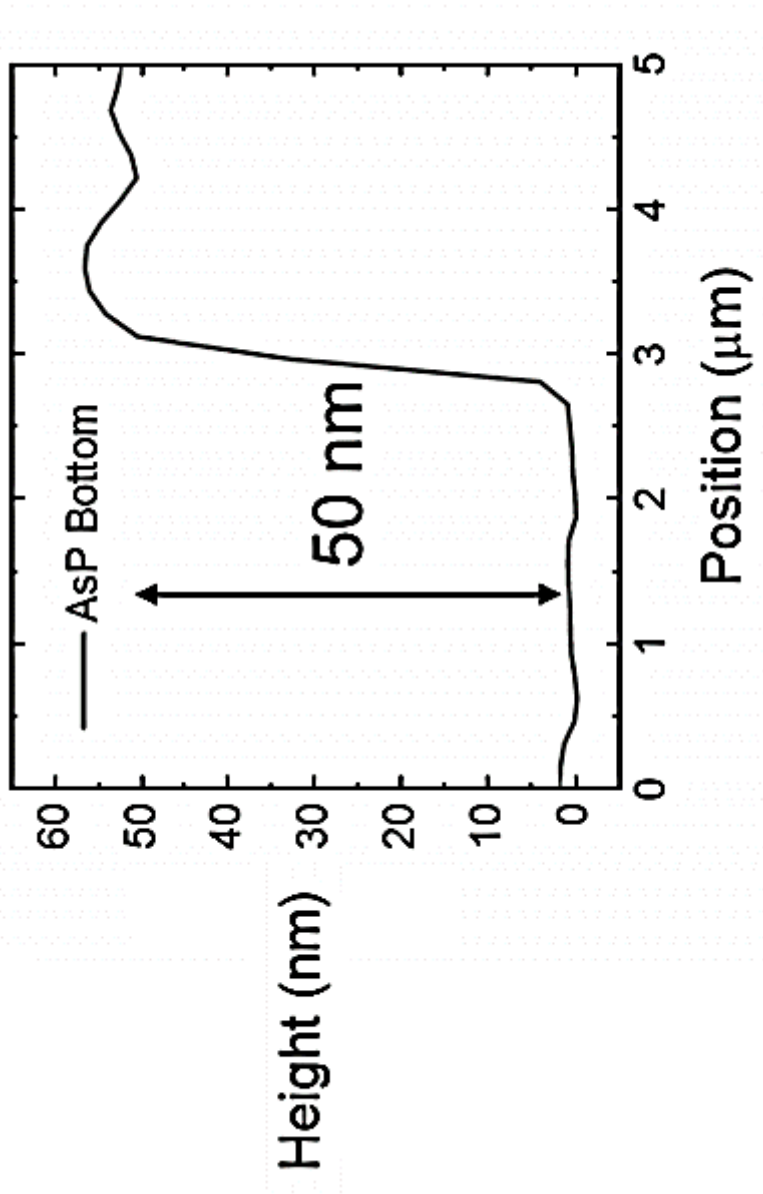

AsP Bottom
50 nm
Height (nm)
Position (μm)
0
10
20
30
40
50
60
0
1
2
3
4
5

FIG. 10D

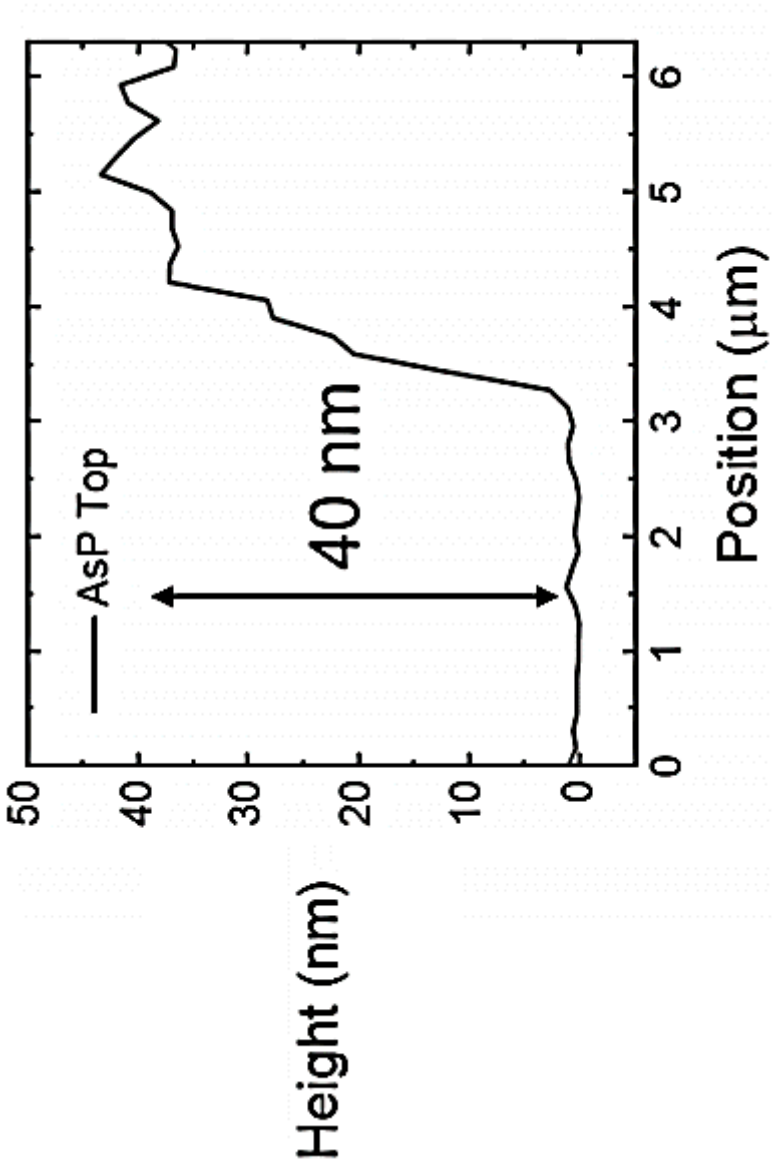


FIG. 11A

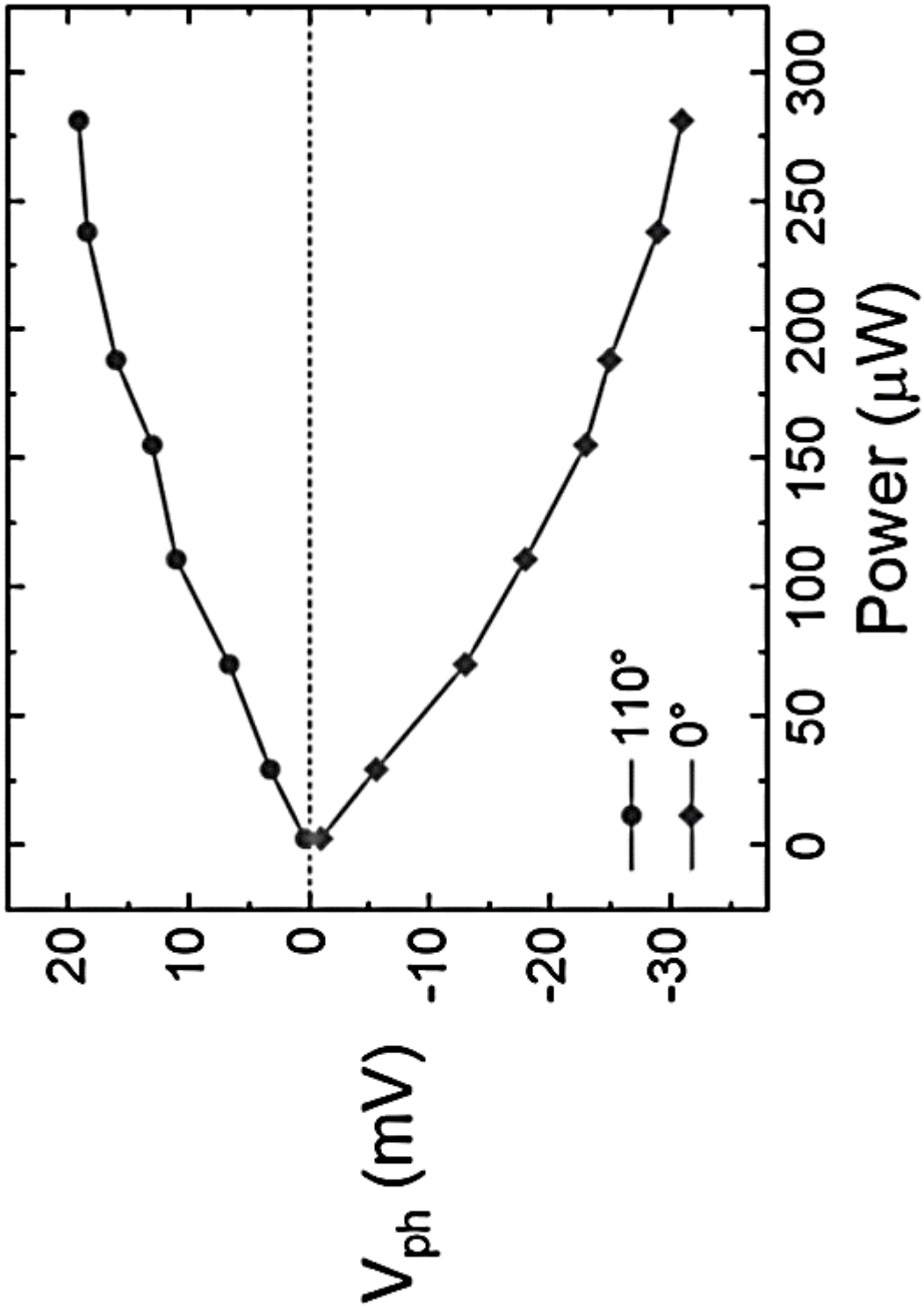


FIG. 11B

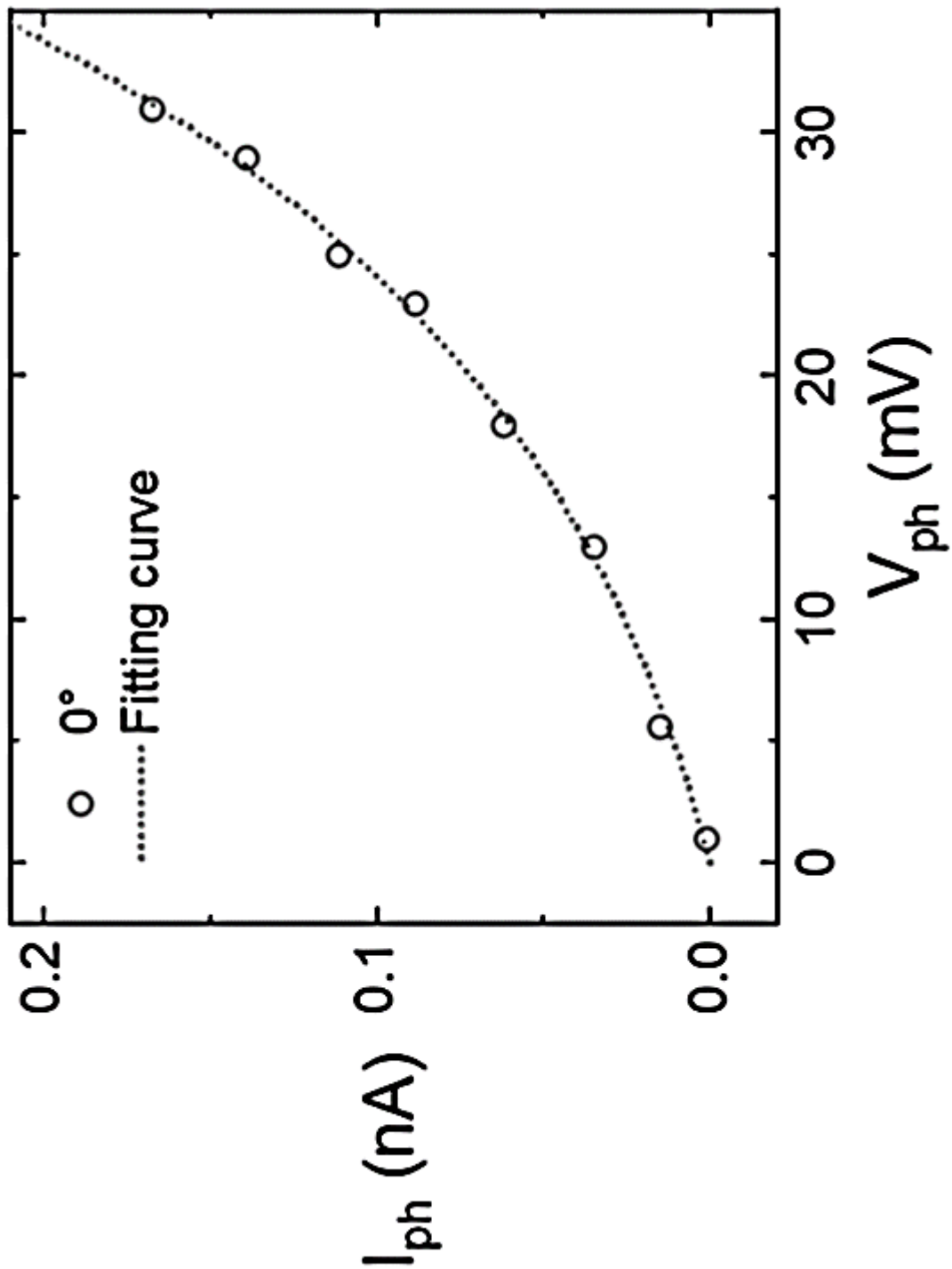


FIG. 11C

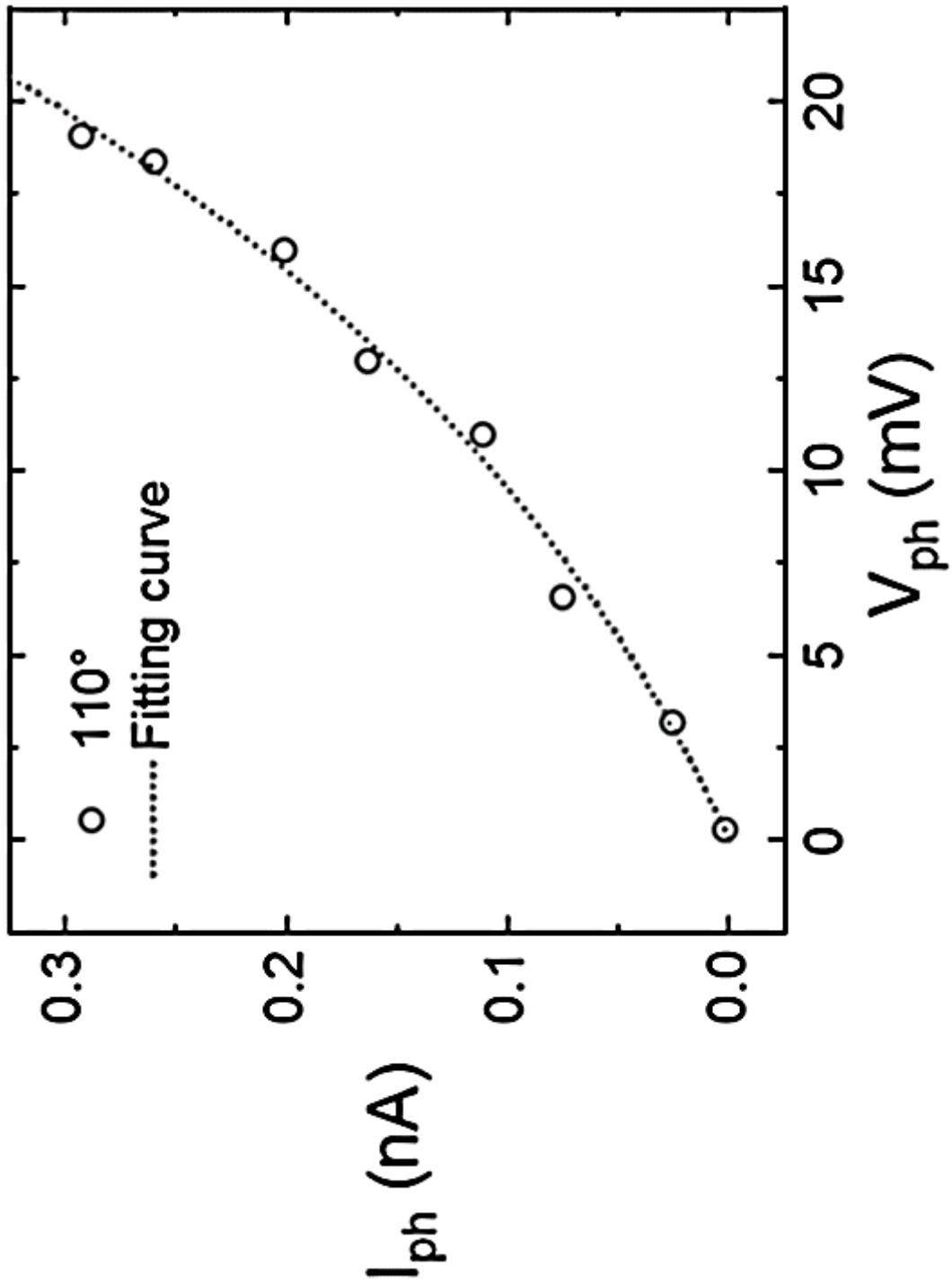


FIG. 11D

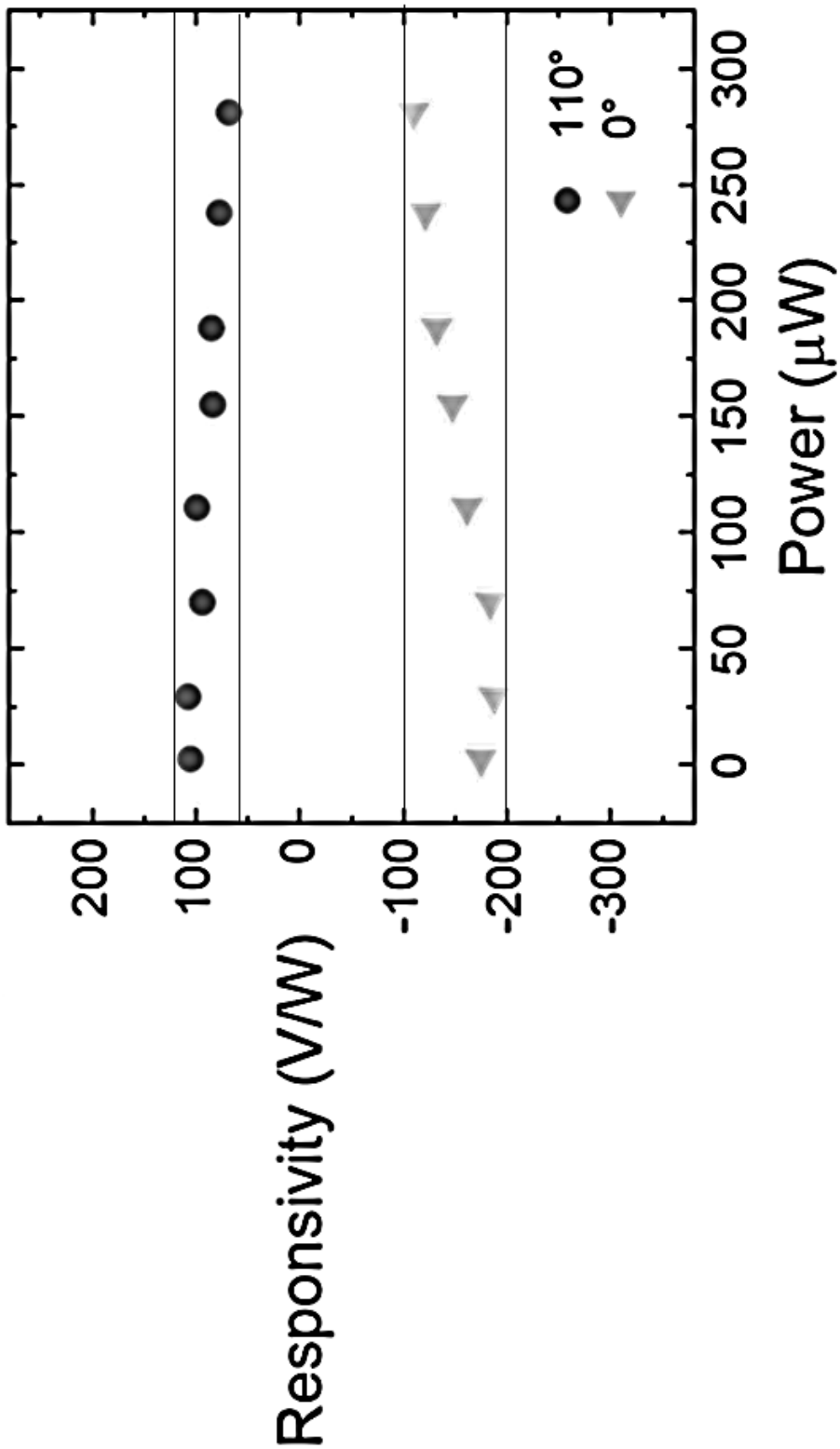

Responsivity (V/W)
200
100
0
-100
-200
-300
0
50
100
150
200
250
300
Power (μW)
110°
0°

FIG. 11E

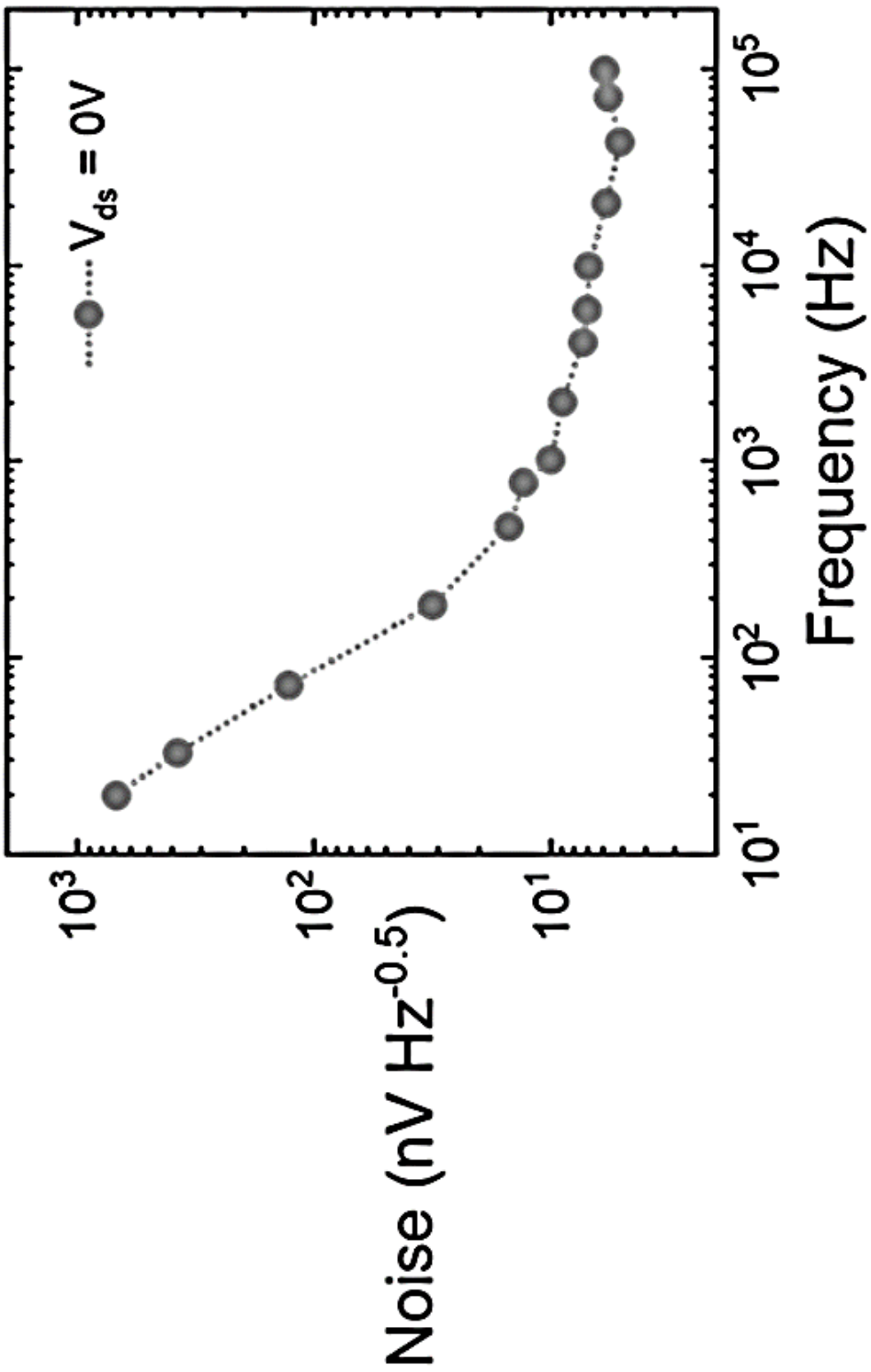

V_{ds} = 0V
Noise (nV Hz$^{-0.5}$)
Frequency (Hz)
10^3
10^2
10^1
10^1
10^2
10^3
10^4
10^5

FIG. 11F

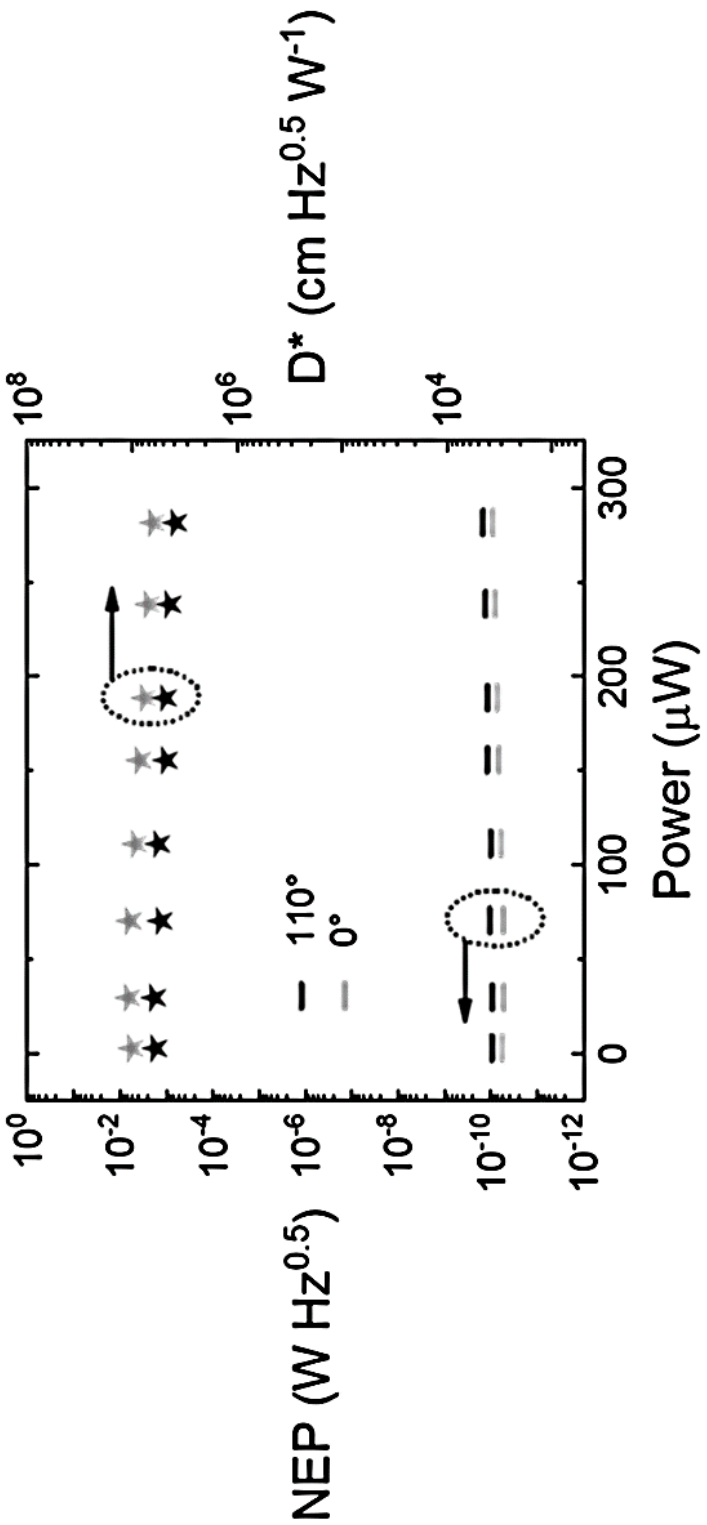

D* (cm Hz^0.5 W^-1)
10^8
10^6
10^4
NEP (W Hz^0.5)
10^0
10^-2
10^-4
10^-6
10^-8
10^-10
10^-12
110°
0°
0
100
200
300
Power (μW)

FIG. 12A

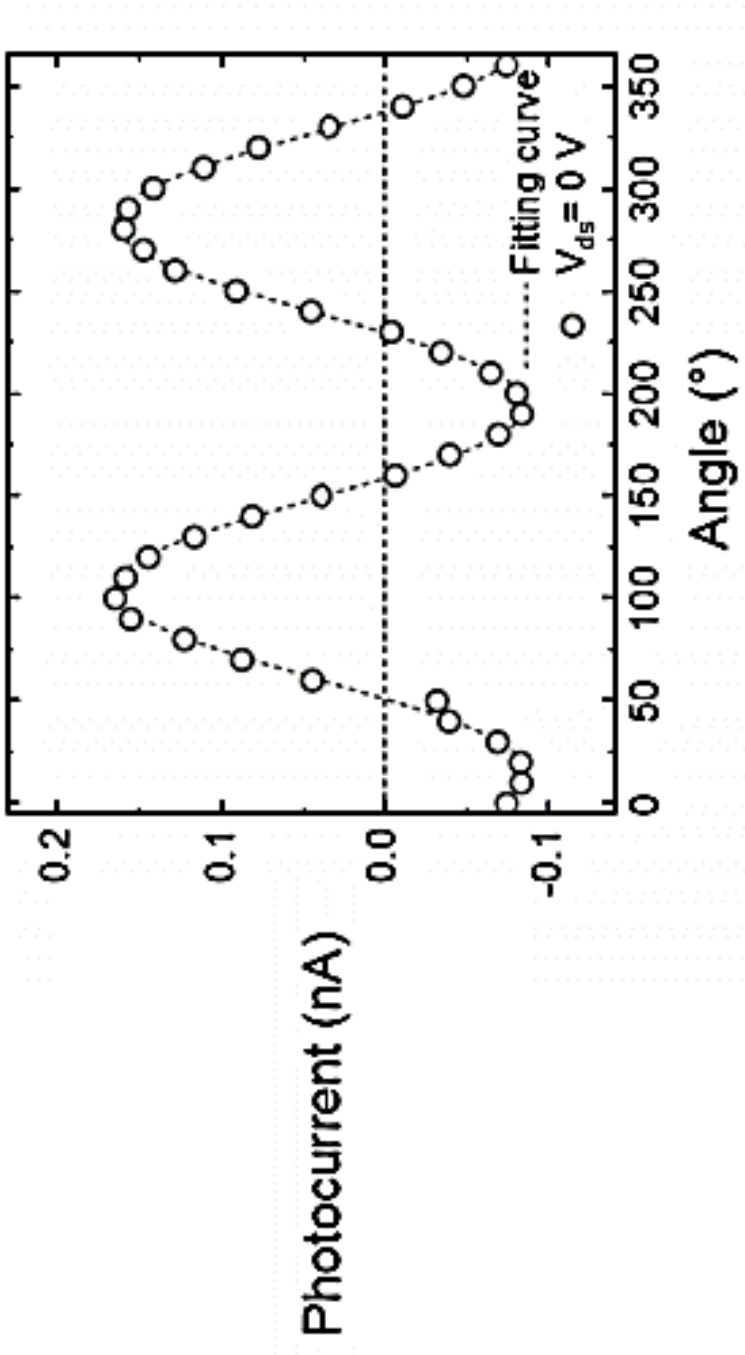

Photocurrent (nA)
0.2
0.1
0.0
-0.1
0
50
100
150
200
250
300
350
Angle (°)
Fitting curve
V_{ds} = 0 V

FIG. 12B

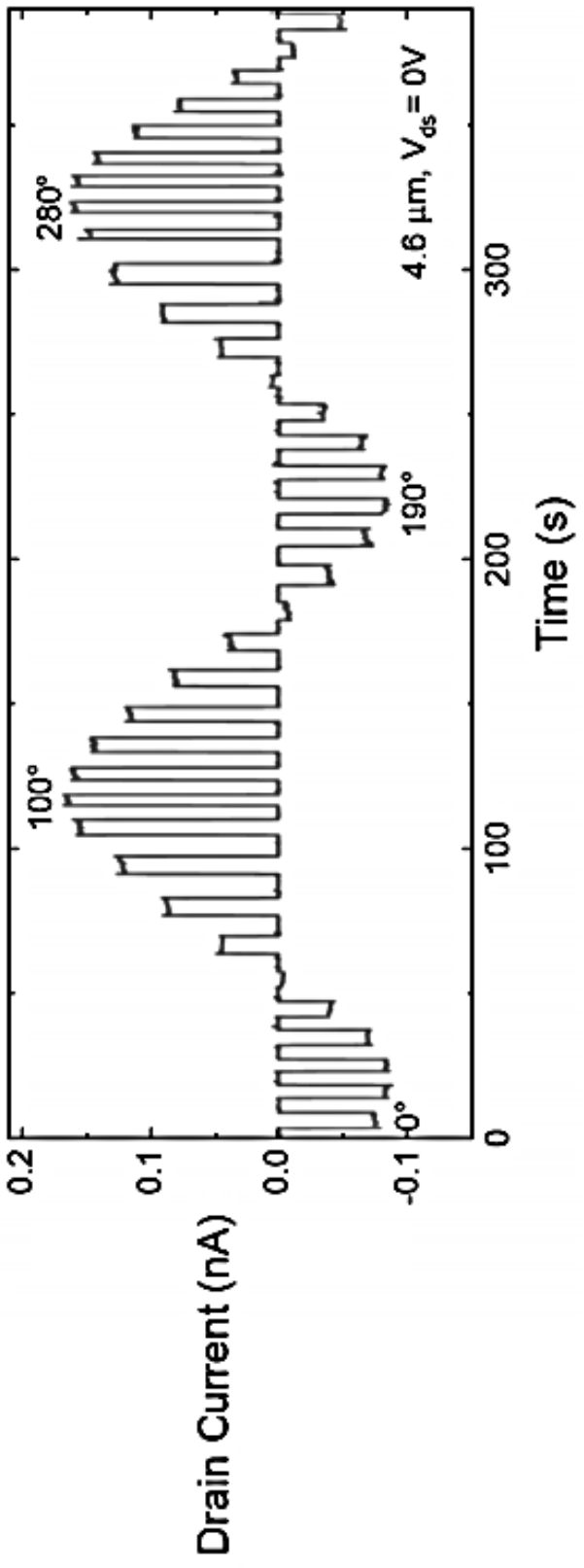

Drain Current (nA)
0.2
0.1
0.0
-0.1
0
100
200
300
Time (s)
0°
100°
190°
280°
4.6 µm, V_{ds} = 0V

FIG. 13A

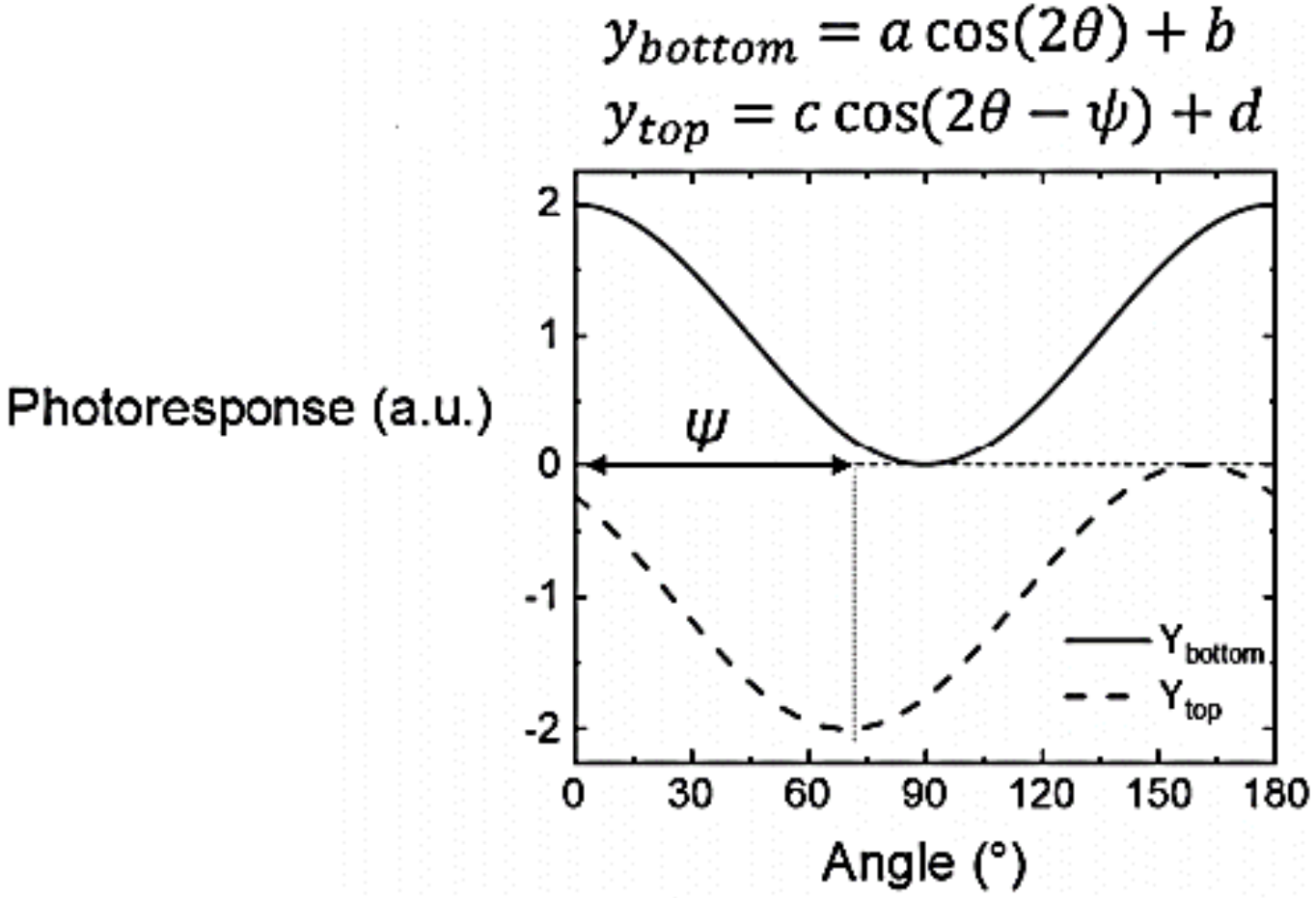

$y_{bottom} = a\cos(2\theta) + b$
$y_{top} = c\cos(2\theta - \psi) + d$
Photoresponse (a.u.)
2
1
0
-1
-2
ψ
Y_{bottom}
Y_{top}
0
30
60
90
120
150
180
Angle (°)

FIG. 13B

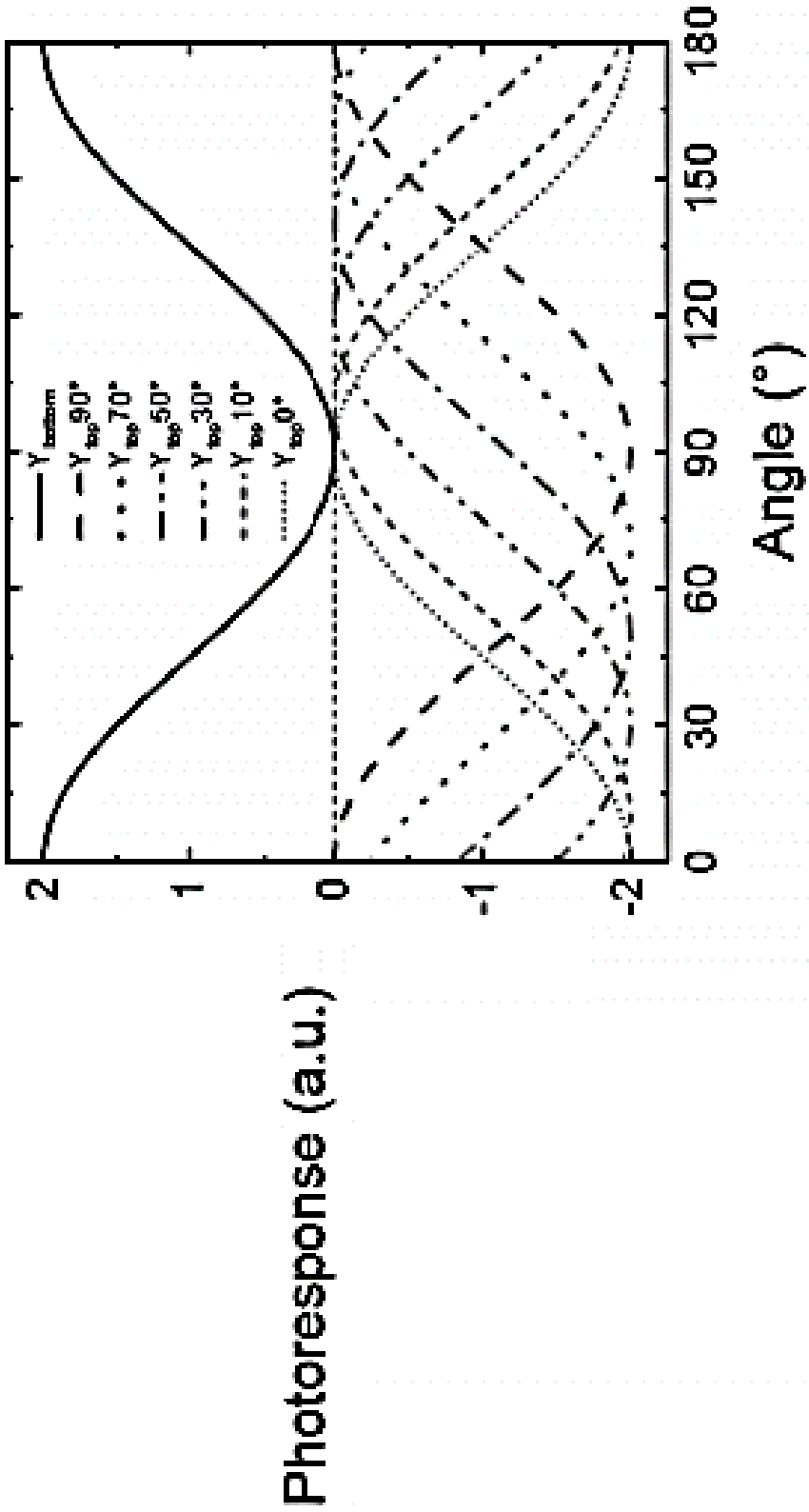

Photoresponse (a.u.)
2
1
0
-1
-2
0
30
60
90
120
150
180
Angle (°)
Y bottom
Y top 90°
Y top 70°
Y top 50°
Y top 30°
Y top 10°
Y top 0°

FIG. 13C

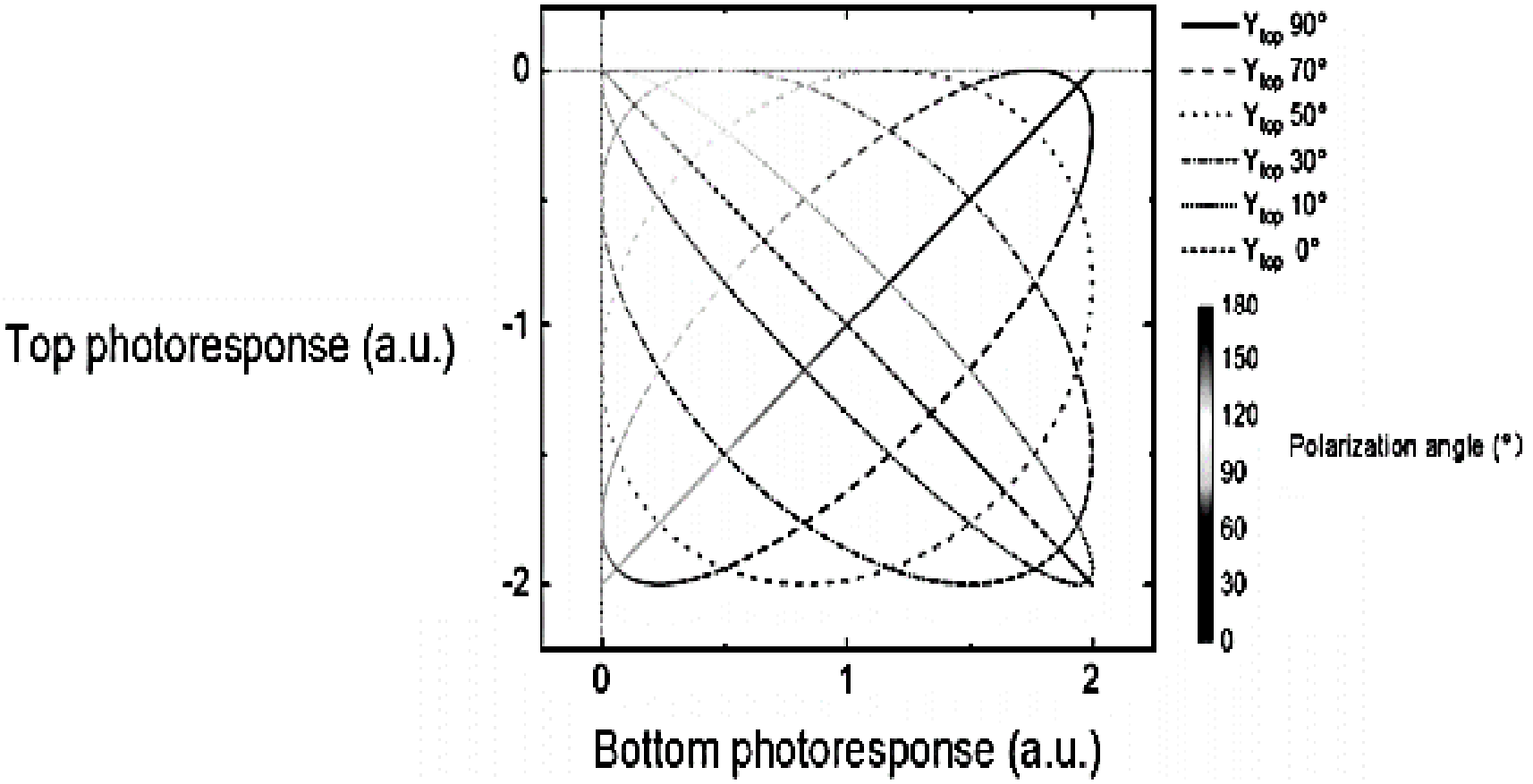

Top photoresponse (a.u.)
0
-1
-2
0
1
2
Bottom photoresponse (a.u.)
Y_{top} 90°
Y_{top} 70°
Y_{top} 50°
Y_{top} 30°
Y_{top} 10°
Y_{top} 0°
180
150
120
90
60
30
0
Polarization angle (°)

FIG. 14A

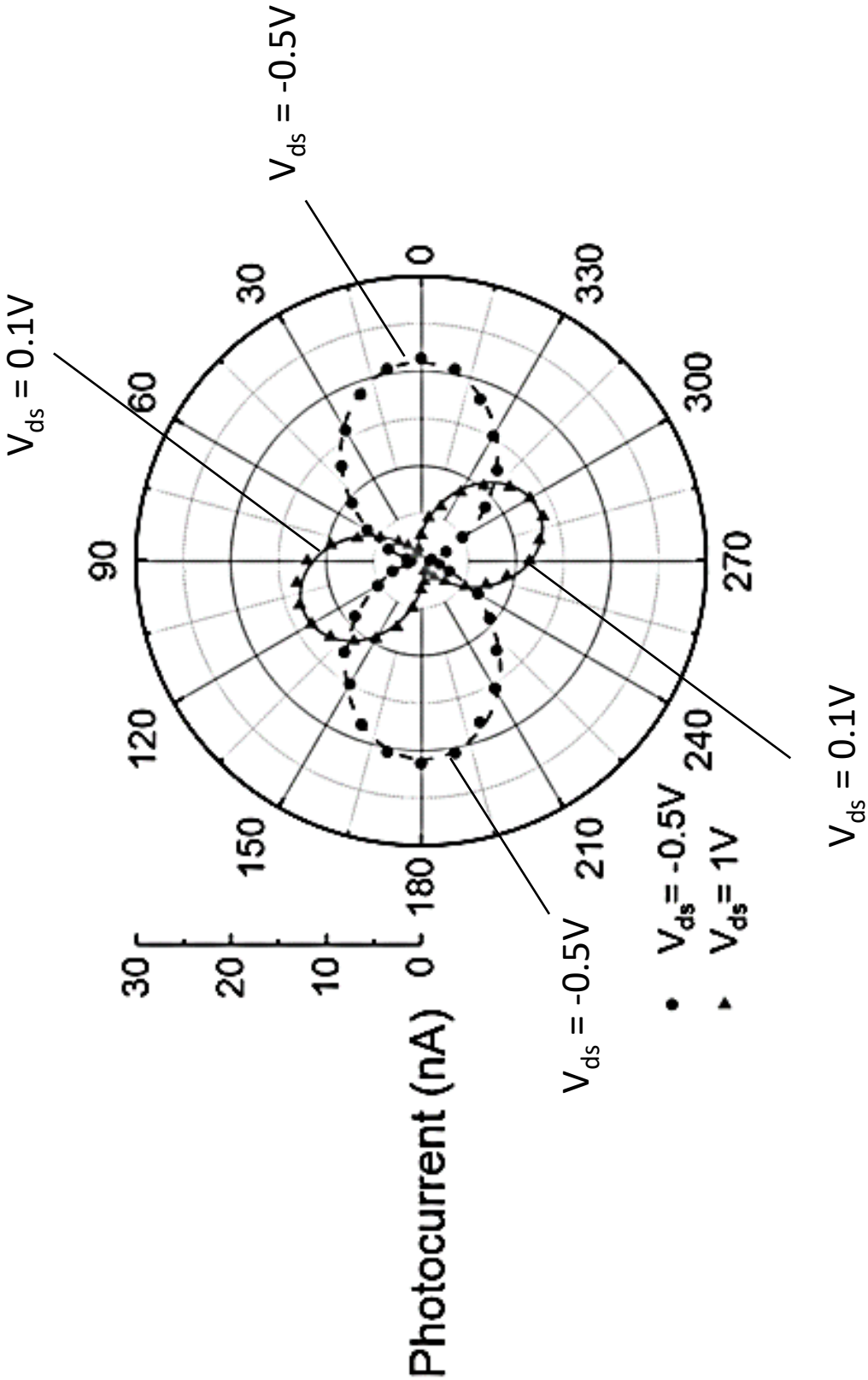

V_ds = -0.5V
V_ds = 0.1V
V_ds = -0.5V
V_ds = 0.1V
V_ds= -0.5V
V_ds= 1V
Photocurrent (nA)
0
10
20
30
0
30
60
90
120
150
180
210
240
270
300
330

FIG. 14B

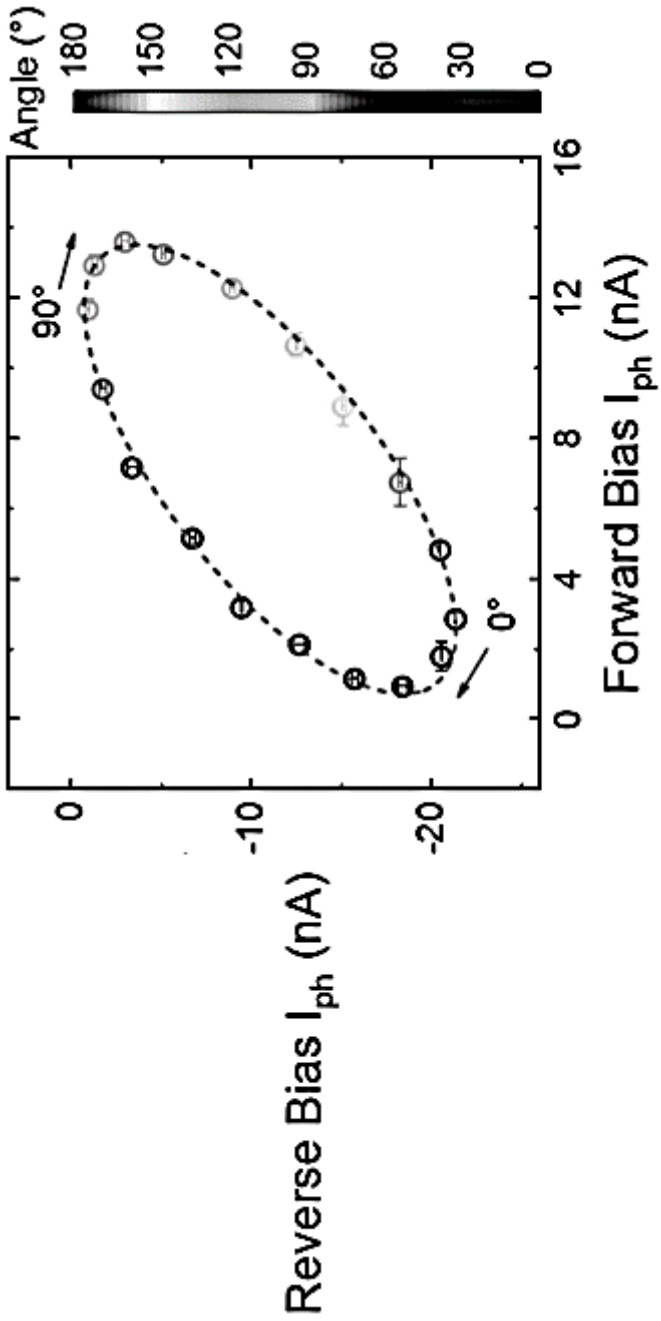

Angle (°)
180
150
120
90
60
30
0
90°
0°
0
-10
-20
Reverse Bias I_{ph} (nA)
0
4
8
12
16
Forward Bias I_{ph} (nA)

FIG. 14C

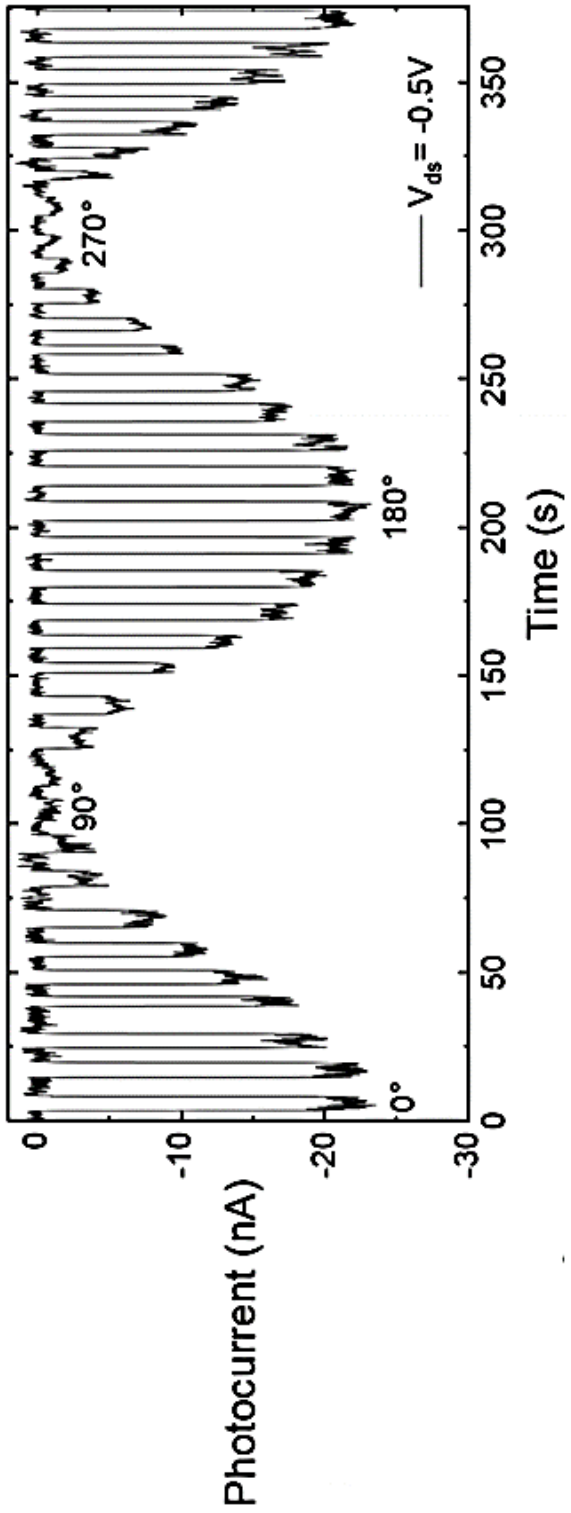
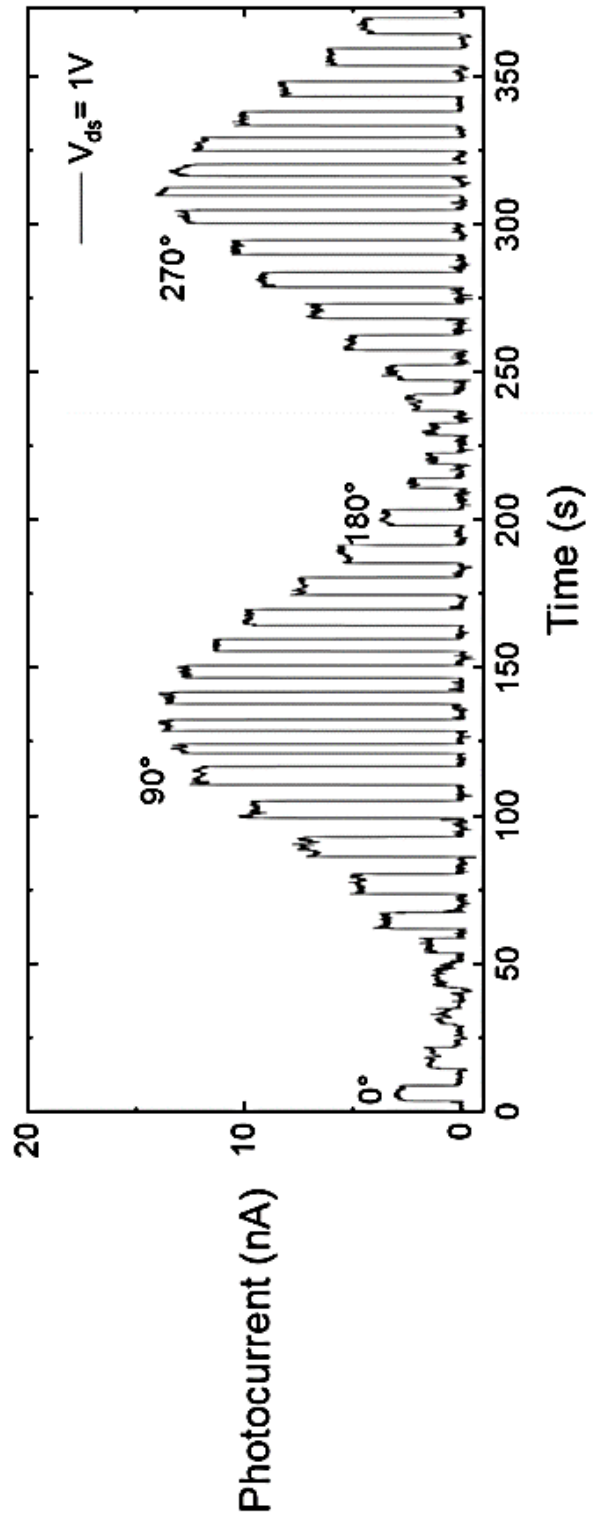

Photocurrent (nA)
0
-10
-20
-30
0
50
100
150
200
250
300
350
Time (s)
0°
90°
180°
270°
V_{ds} = -0.5V

FIG. 14D


Photocurrent (nA)
Time (s)
V_{ds} = 1V
0°
90°
180°
270°
0
10
20
0
50
100
150
200
250
300
350