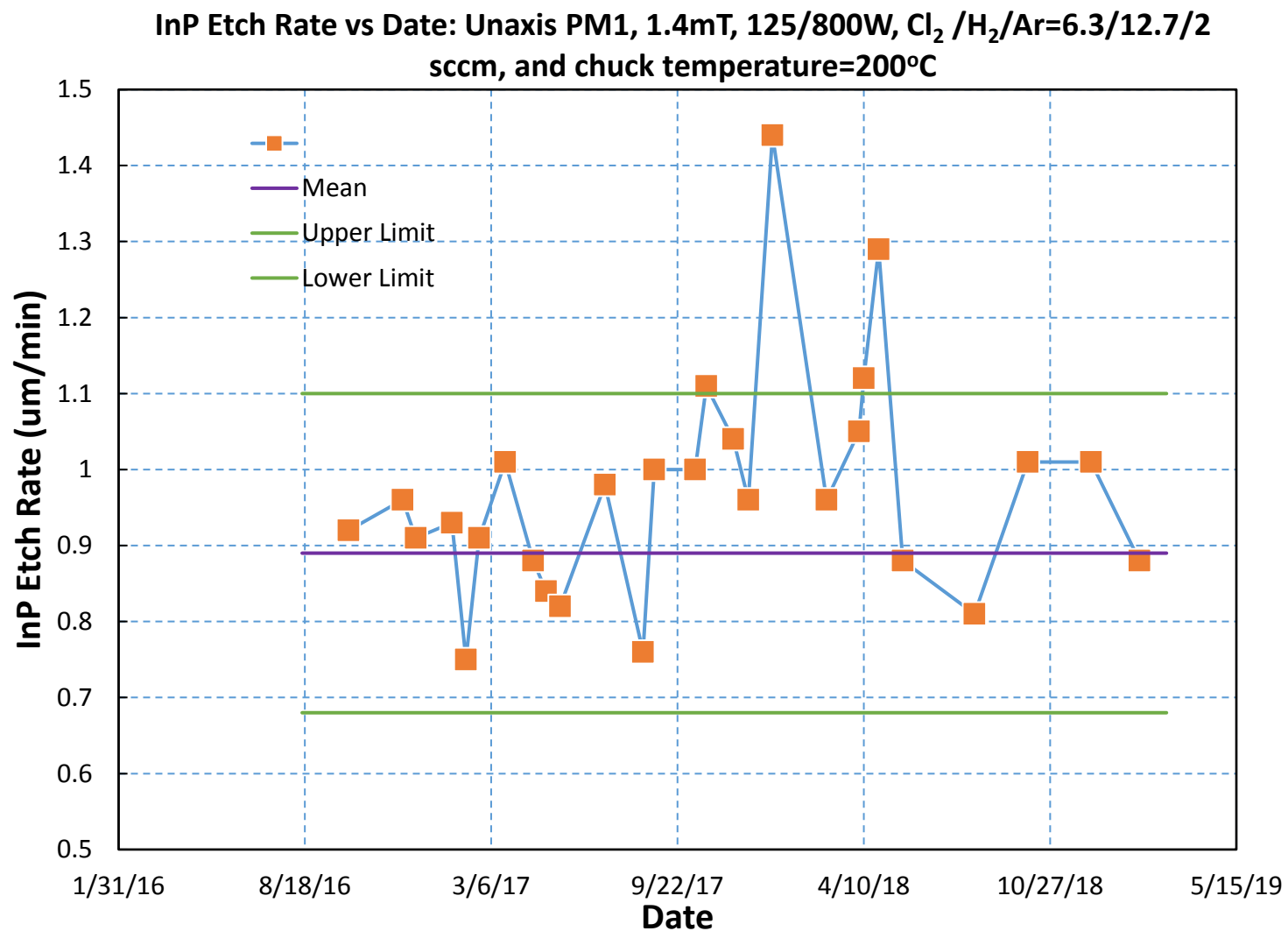
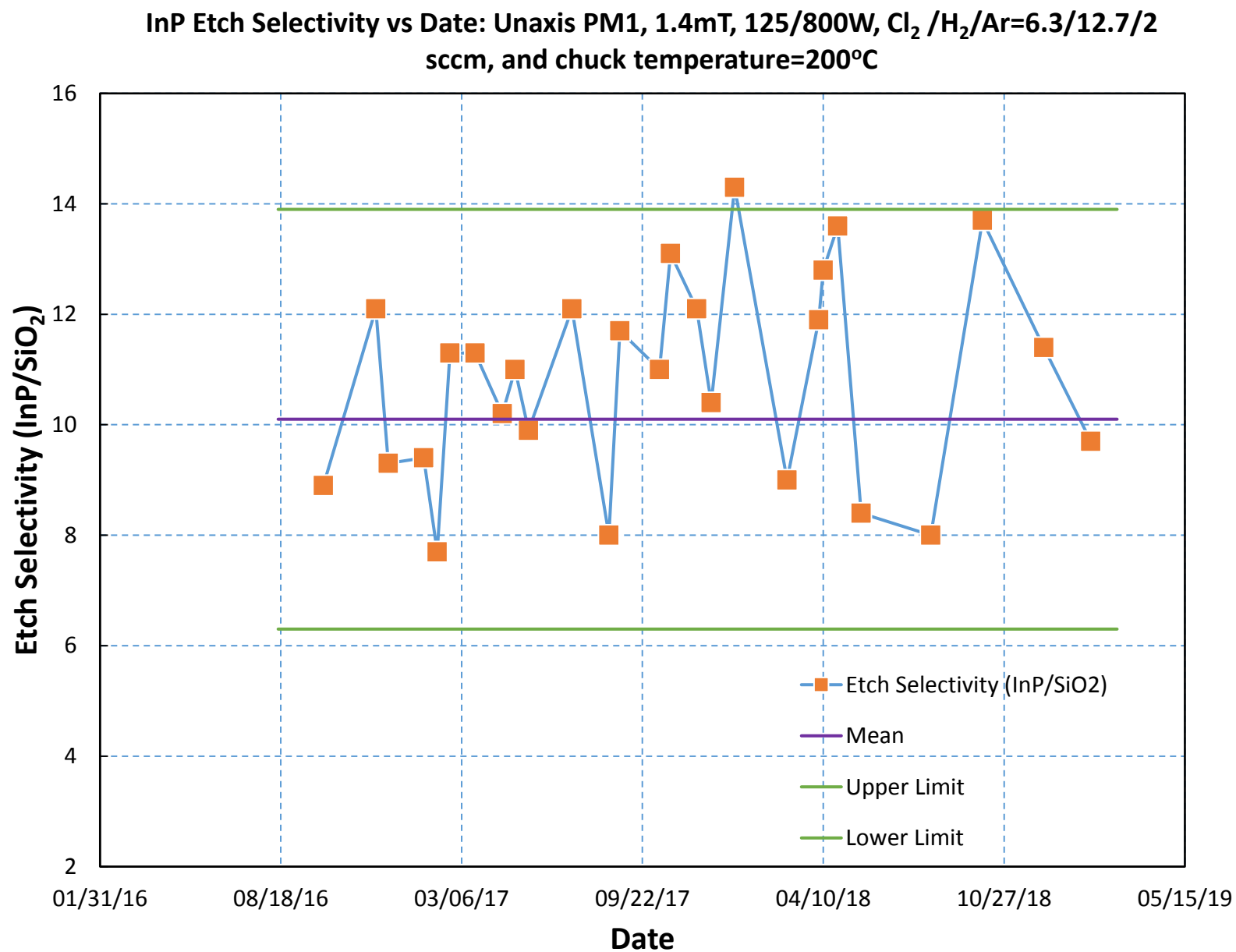


InP Etch using Unaxis PM1 at 200 C





Ning Cao, Staff Engineer, Nano-fabrication Lab, UCSB

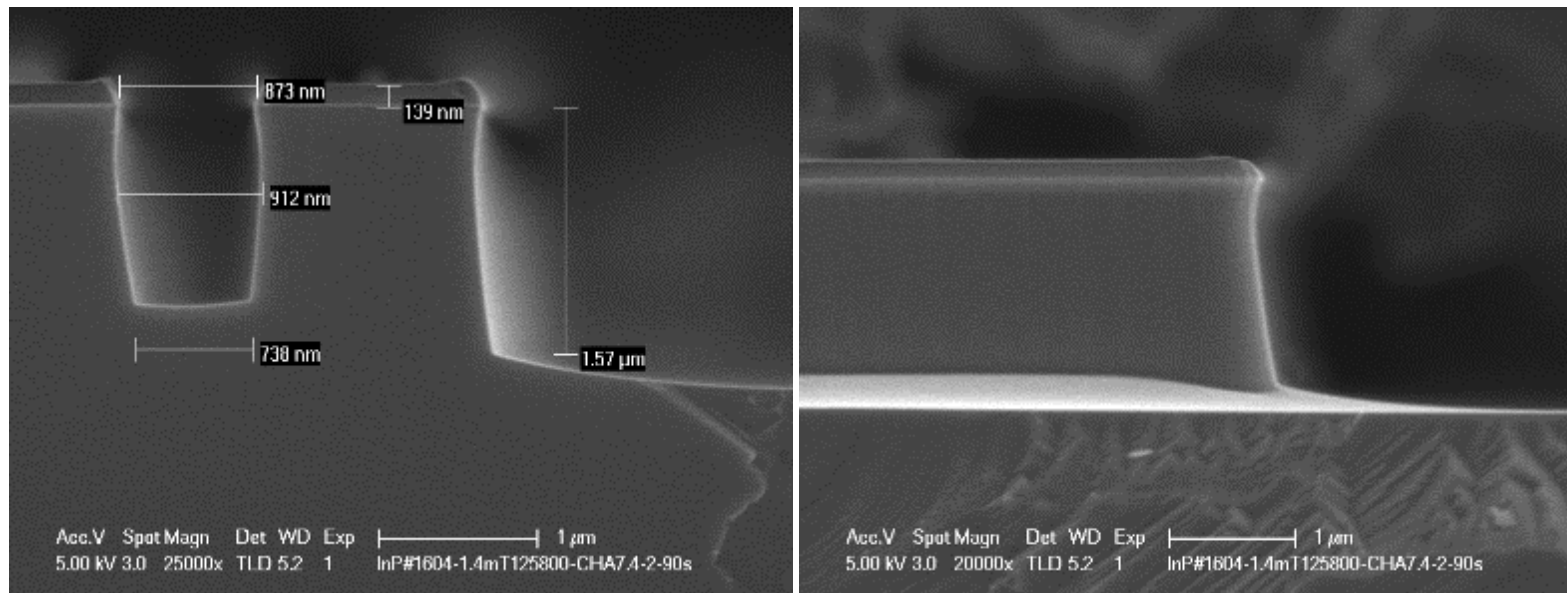
1) Test Date: 6-3-2016

Chamber wall Clean and Coat: 30-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating)

Recipe: 1.4mT, 125/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=7.4/11.6/2 sccm (the sample was glued to Si carrier)

Etch rate: 1.02  $\mu\text{m}/\text{min}$

Etch Profile



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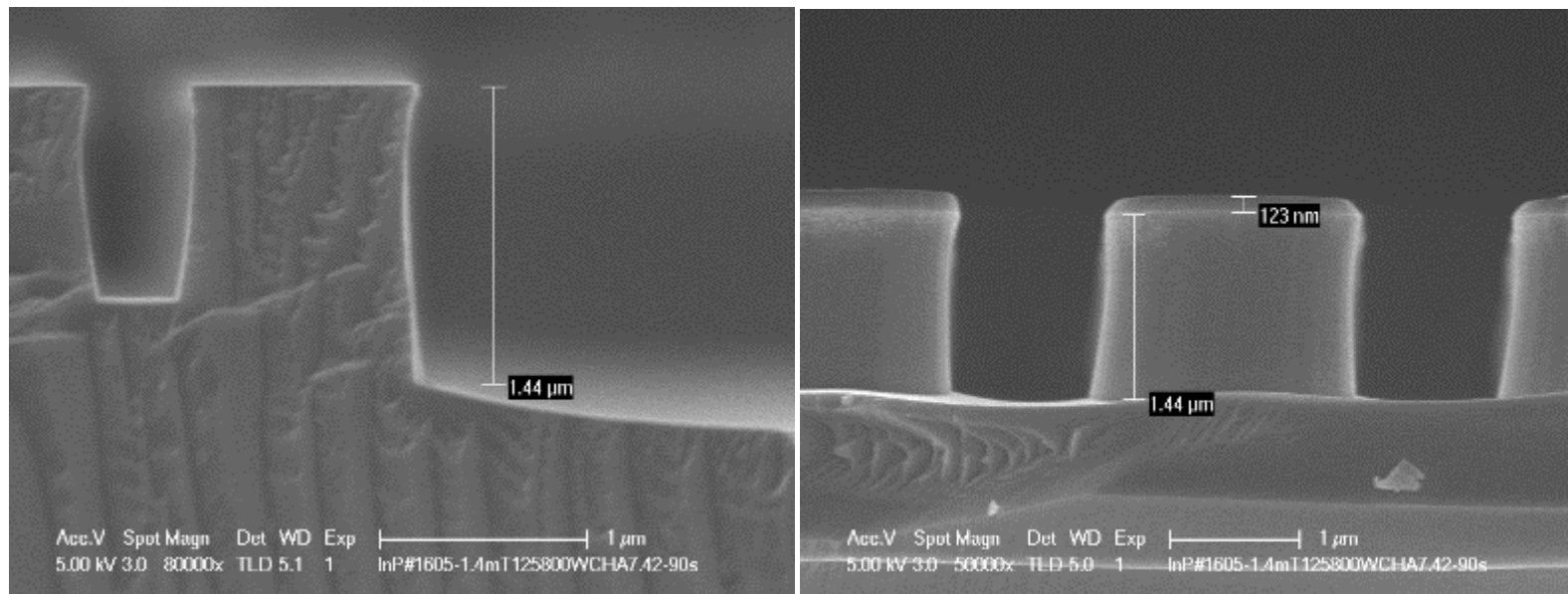
2) Test Date: 6-16-2016

Chamber wall Clean and Coat: 30-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating)

Recipe: 1.4mT, 125/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=7.4/11.6/2 sccm (the sample was glued to Si carrier)

Etch rate: 0.97  $\mu\text{m}/\text{min}$

Etch Profile



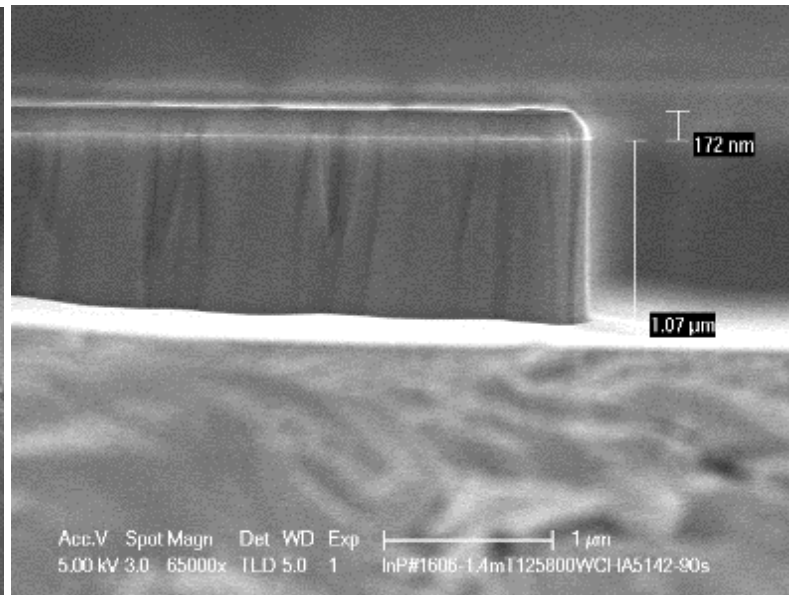
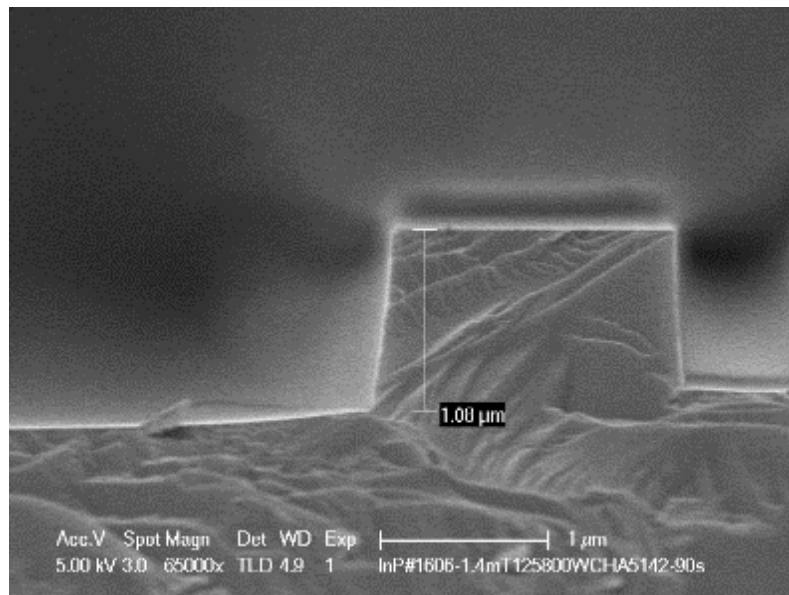
3) Test Date: 7-1-2016

Chamber wall Clean and Coat: 30-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating)

Recipe: 1.4mT, 125/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=5/14/2 sccm (the sample was glued to Si carrier)

Etch rate: 0.71  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) = 7.6

Etch Profile



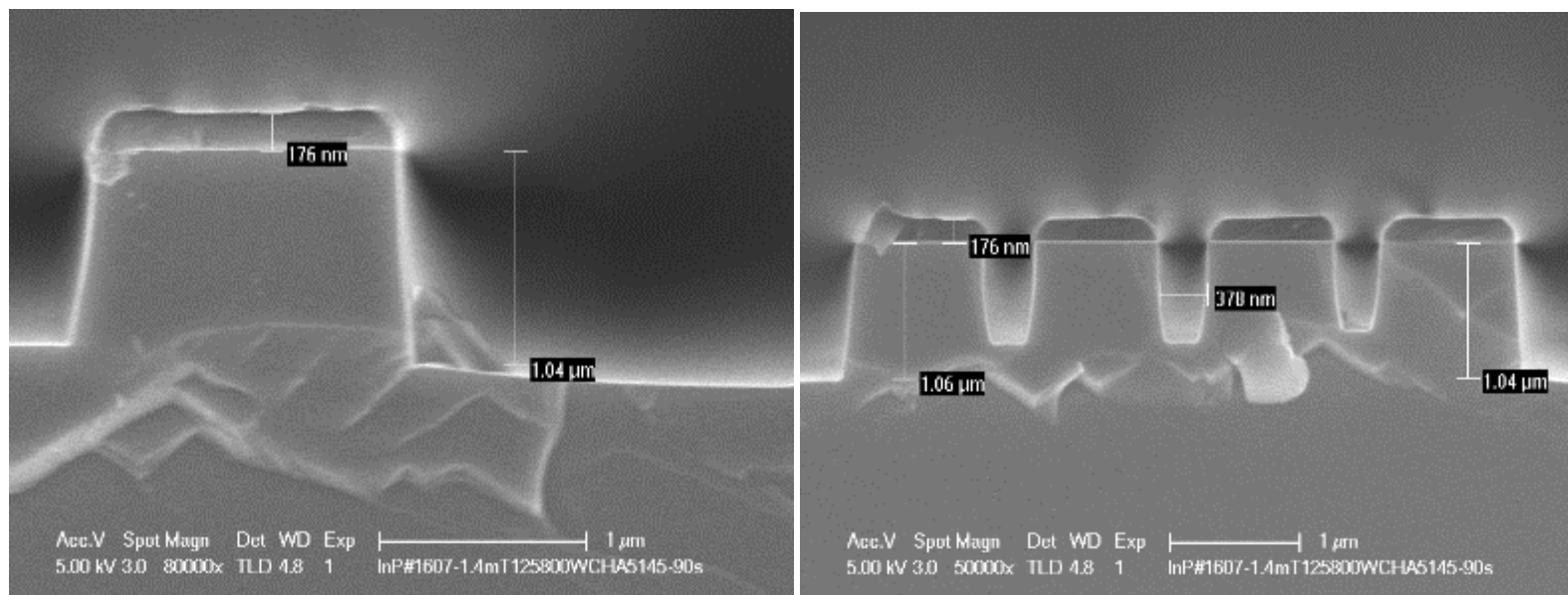
4) Test Date: 7-6-2016

Chamber wall Clean and Coat: 30-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating)

Recipe: 1.4mT, 125/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=5/14/5 sccm (the sample was glued to Si carrier)

Etch rate: 0.70  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) = 7.9

Etch Profile



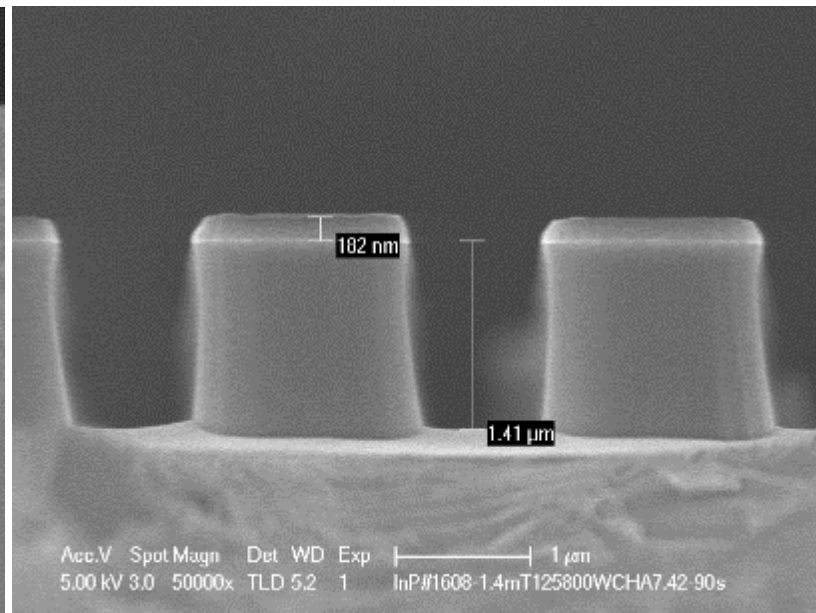
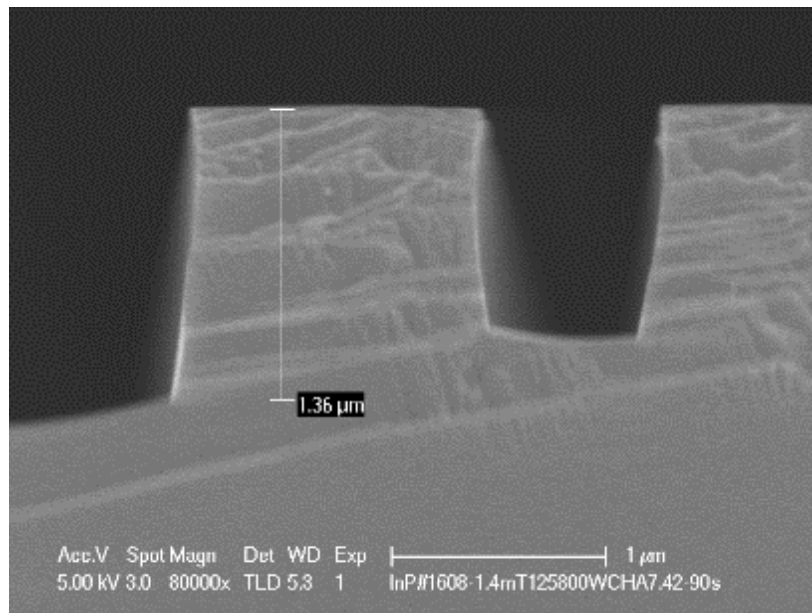
5) Test Date: 7-6-2016

Chamber wall Clean and Coat: 30-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating)

Recipe: 1.4mT, 125/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=7.4/11.6/2 sccm (the sample was glued to Si carrier)

Etch rate: 0.88  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) = 10.2

Etch Profile



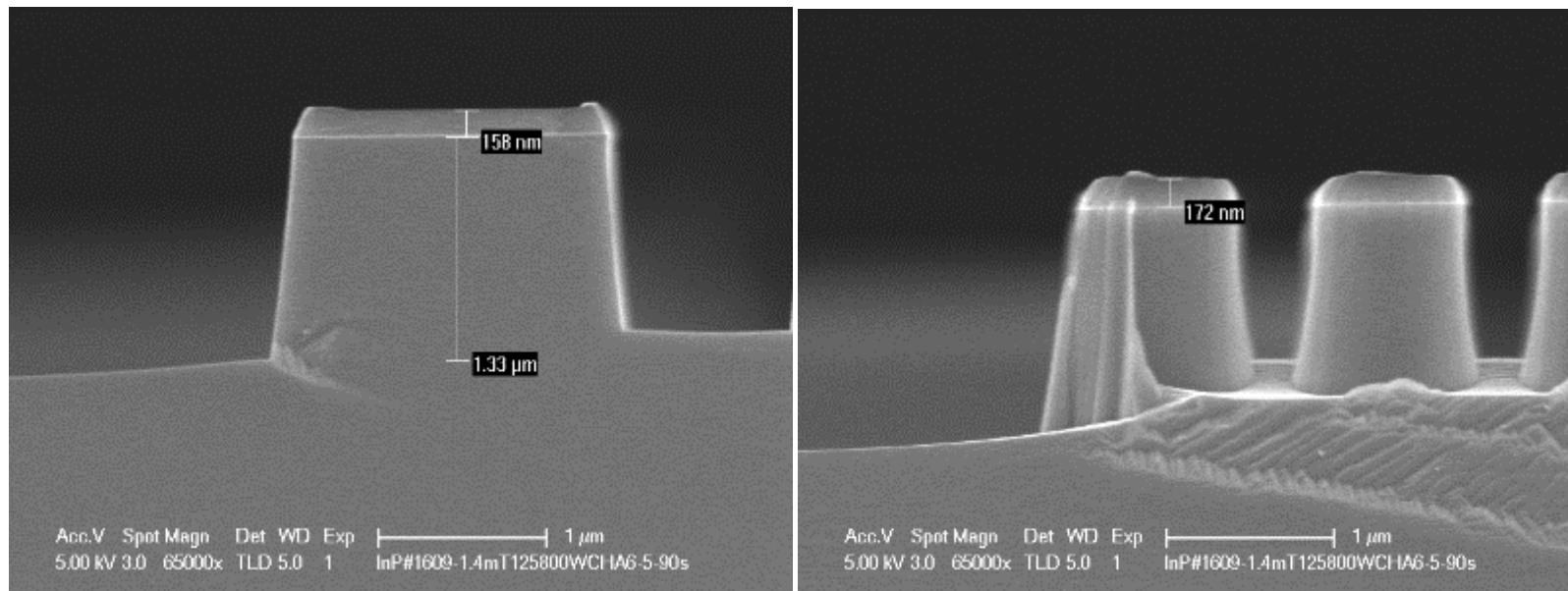
6) Test Date: 7-18-2016

Chamber wall Clean and Coat: 30-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating)

Recipe: 1.4mT, 125/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6/13/5 sccm (the sample was glued to Si carrier)

Etch rate: 0.87  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =8.5

Etch Profile





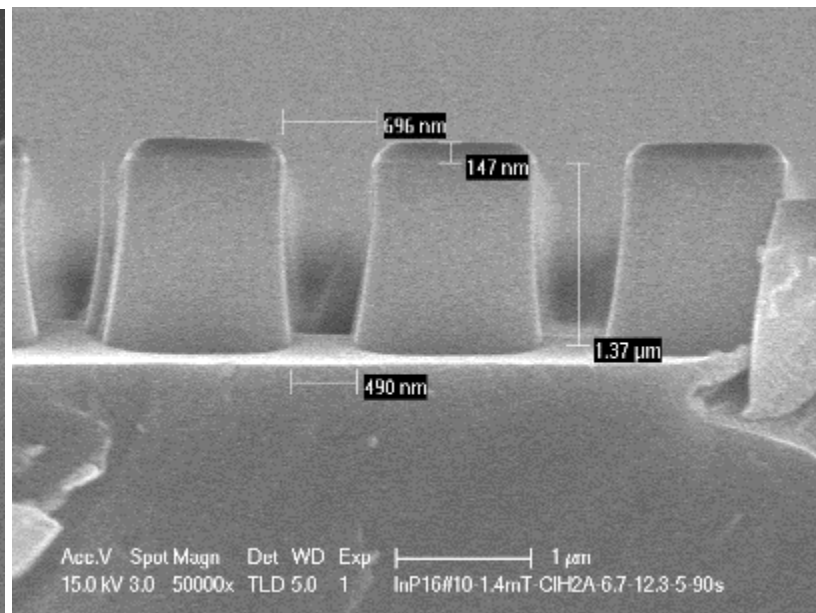
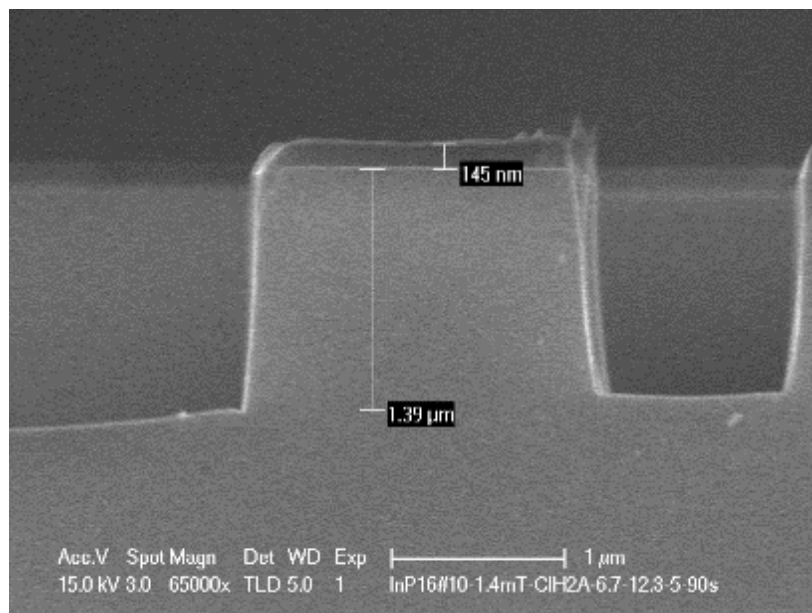
7) Test Date: 8-3-2016

Chamber wall Clean and Coat: 30-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating)

Recipe: 1.4mT, 125/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.7/12.3/5 sccm (the sample was glued to Si carrier)

Etch rate: 0.93  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =8.3

Etch Profile



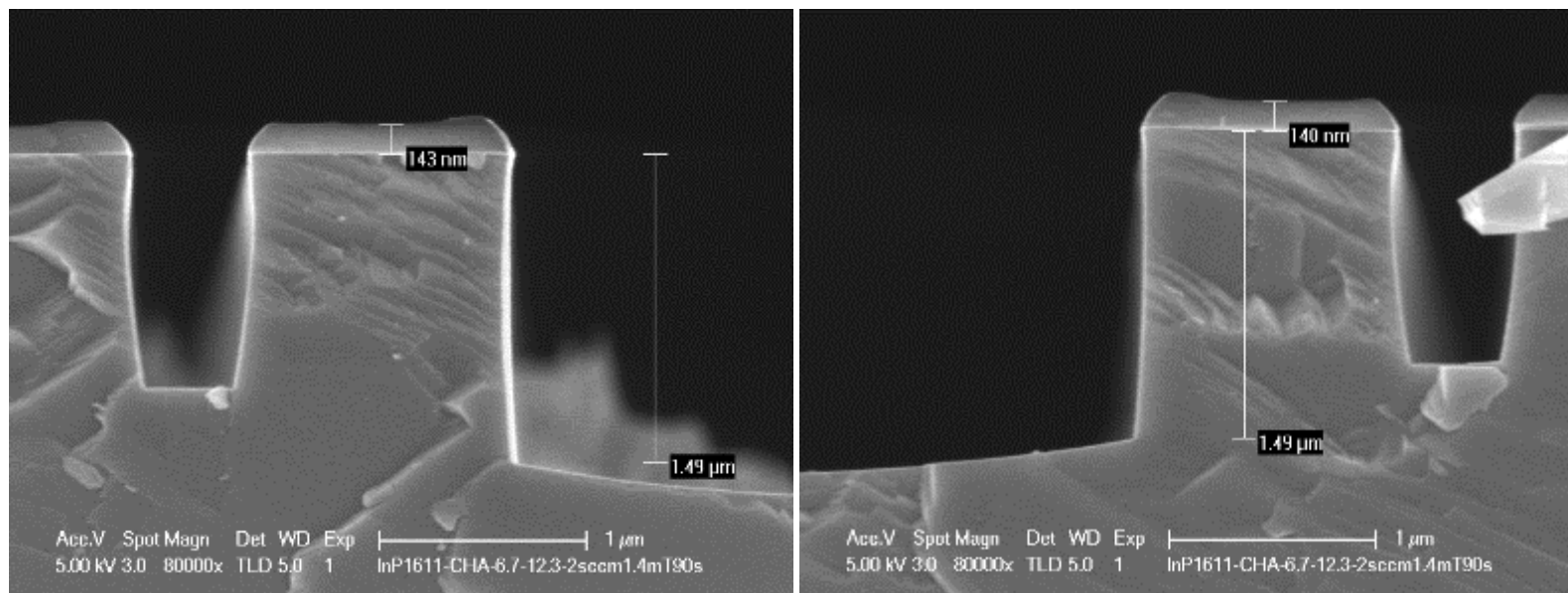
7) Test Date: 9-1-2016

Chamber wall Clean and Coat: 30-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating)

Recipe: 1.4mT, 125/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.7/12.3/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate: 0.99  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =8.7

Etch Profile



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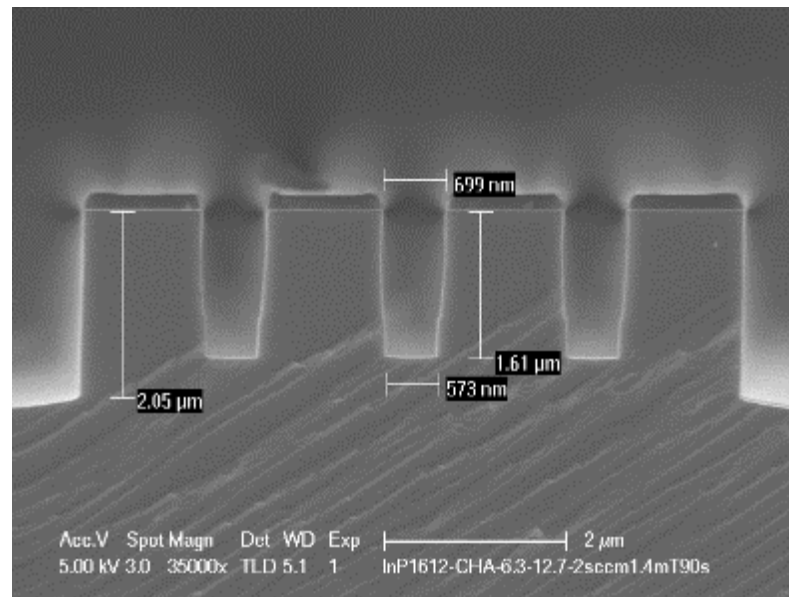
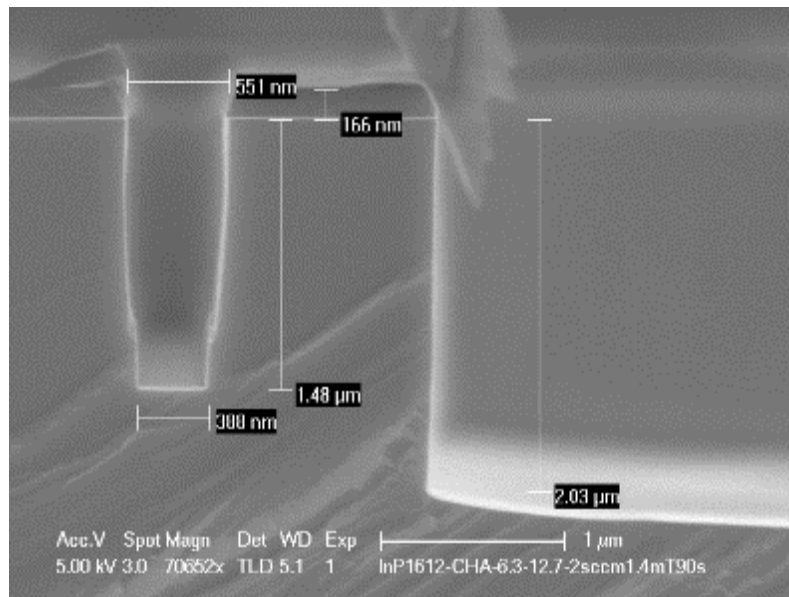
8) Test Date: 9-21-2016

Chamber wall Clean and Coat: 30-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating)

Recipe: 1.4mT, 125/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.3/12.7/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate (open area): 1.37  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =13.7

Etch Profile



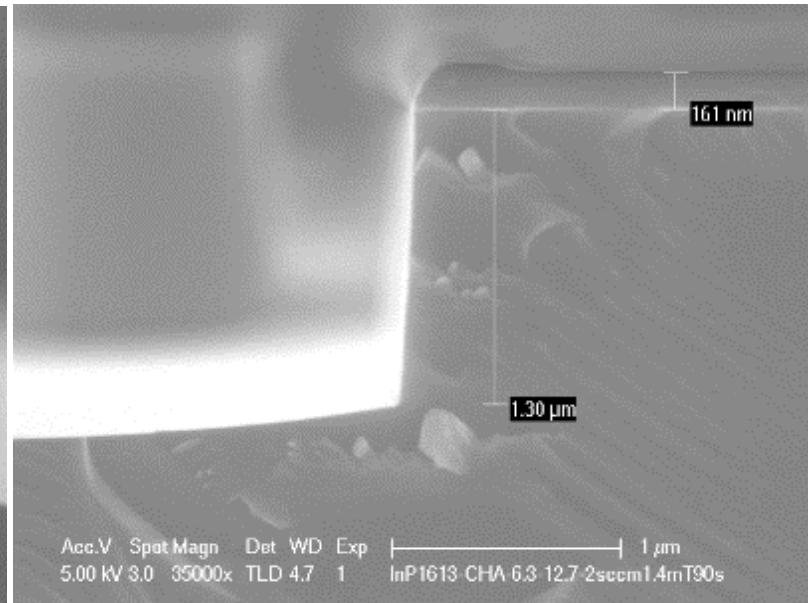
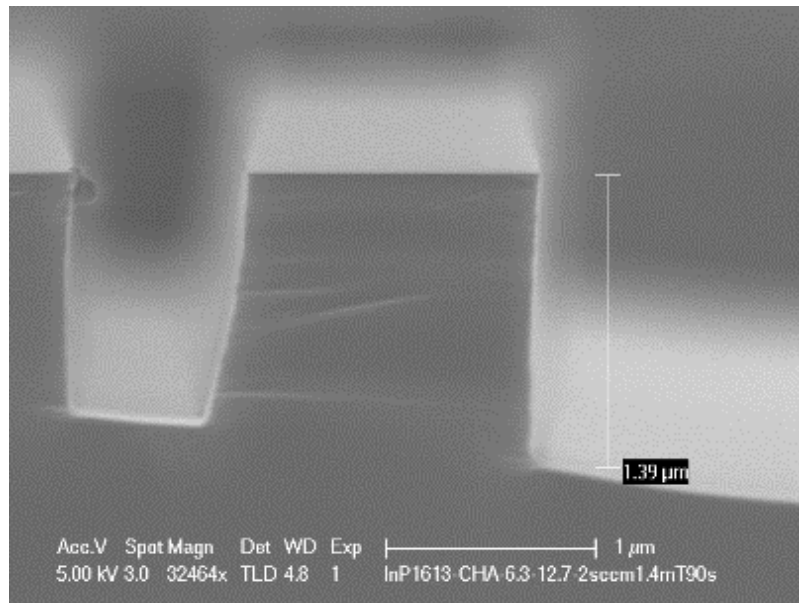
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9) Test Date: 10-4-2016 Chamber wall Clean and Coat: 30-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating)

Recipe: 1.4mT, 125/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.3/12.7/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate (open area): 0.92  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =8.9

Etch Profile



Ning Cao, Staff Engineer, Nano-fabrication Lab, UCSB

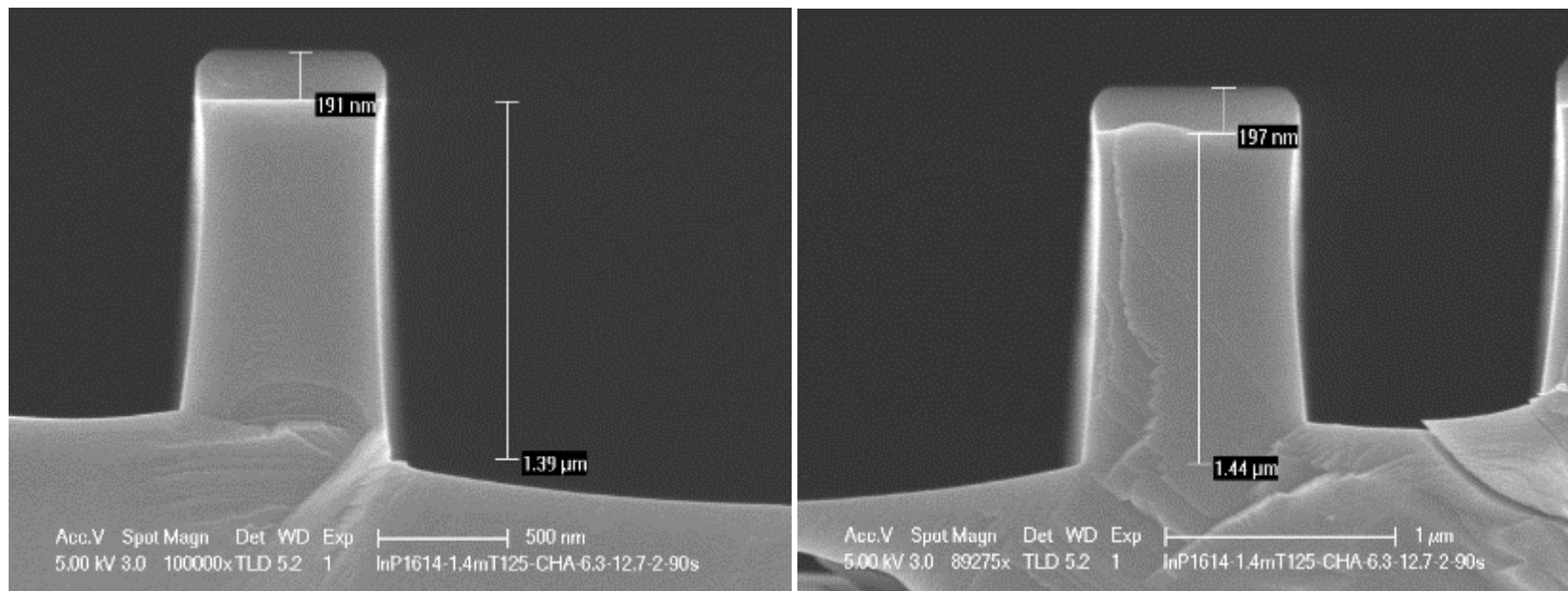
10) Test Date: 12-1-2016

Chamber wall Clean and Coat: 15-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating)

Recipe: 1.4mT, 125/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.3/12.7/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate (open area): 0.96  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =12.1

Etch Profile



Ning Cao, Staff Engineer, Nano-fabrication Lab, UCSB

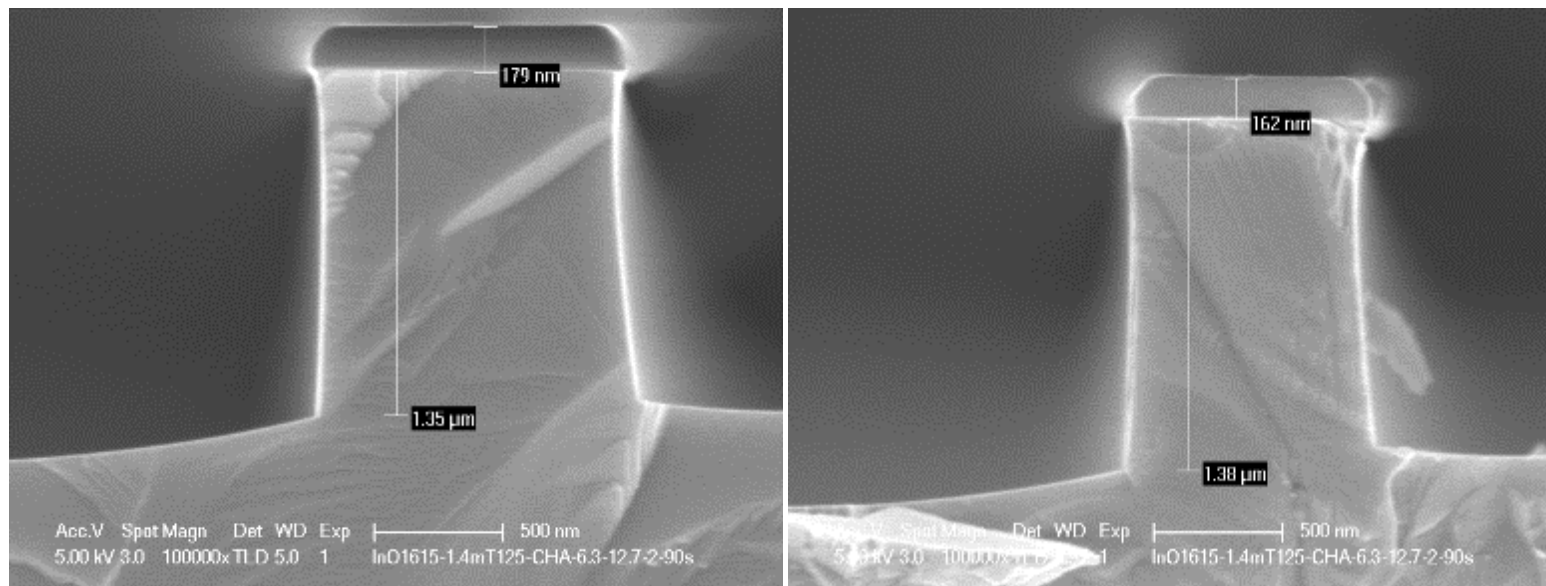
11) Test Date: 12-15-2016

Chamber wall Clean and Coat: 15-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating)

Recipe: 1.4mT, 125/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.3/12.7/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate (open area): 0.91  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =9.3

Etch Profile



Ning Cao, Staff Engineer, Nano-fabrication Lab, UCSB

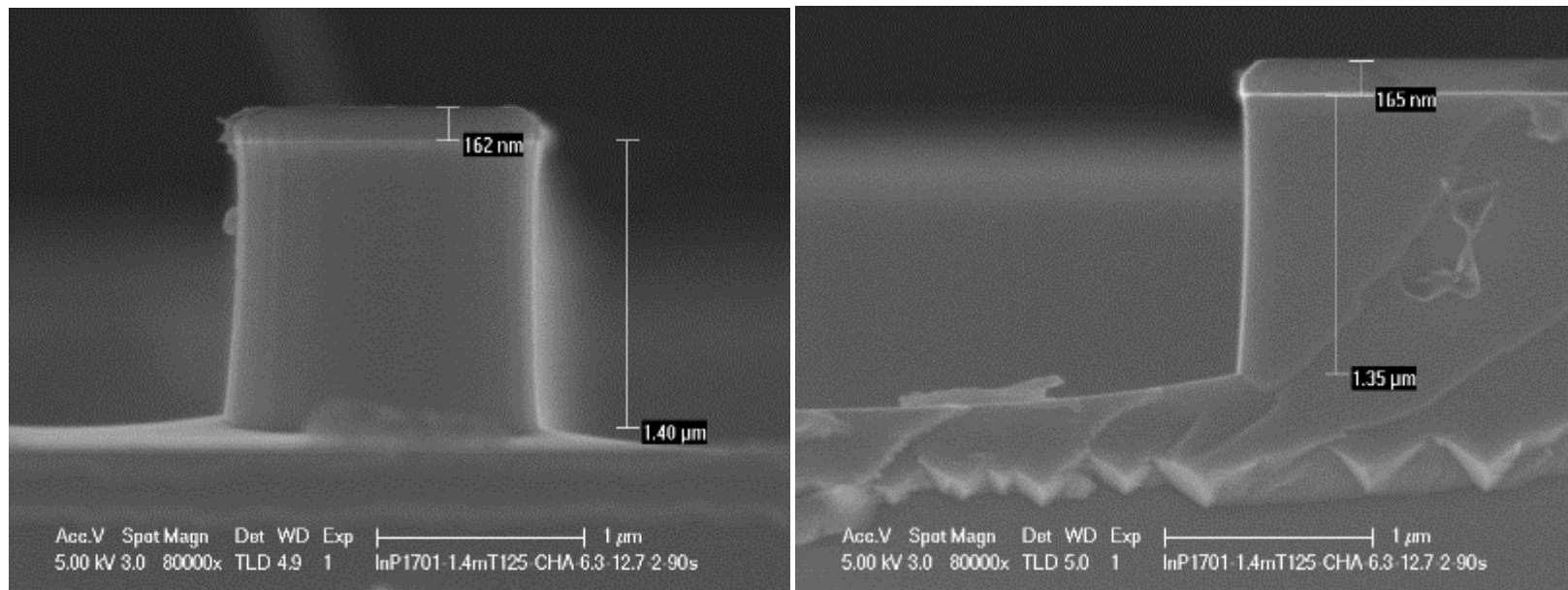
12) Test Date: 1-23-2017

Chamber wall Clean and Coat: 15-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating)

Recipe: 1.4mT, 125/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.3/12.7/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate (open area): 0.93  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =9.4

Etch Profile



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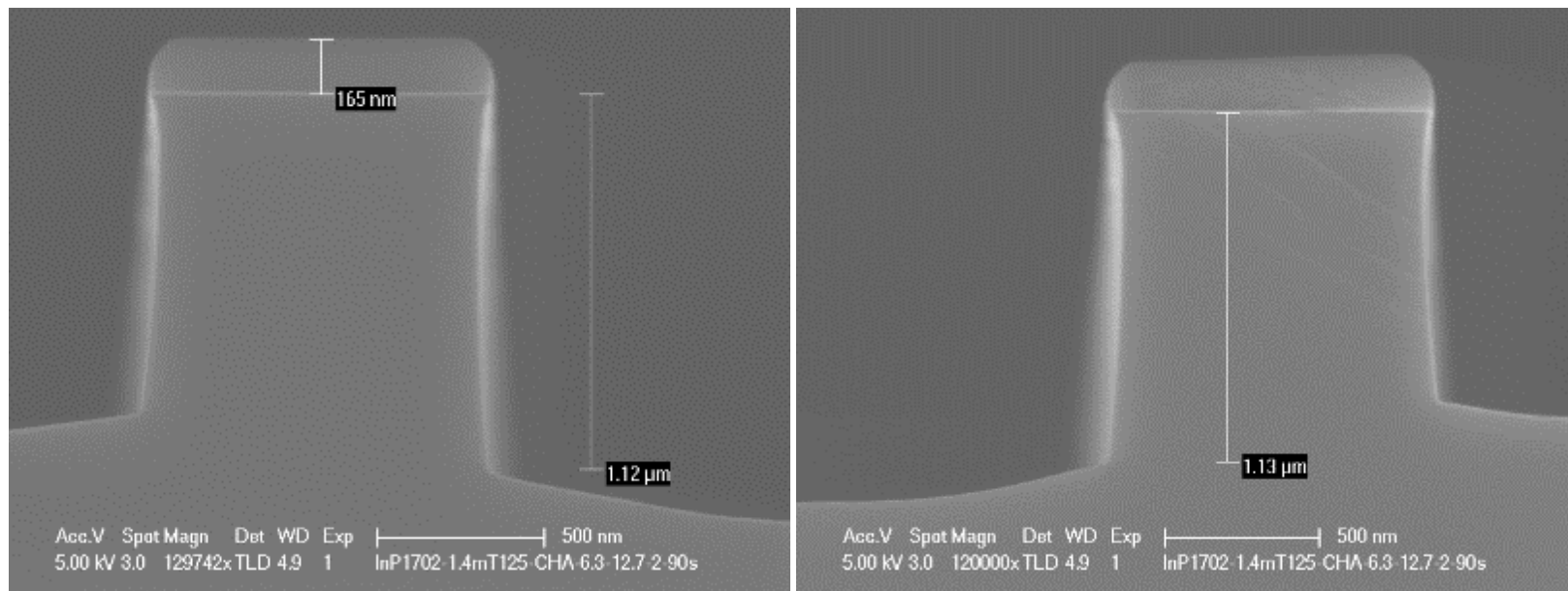
13) Test Date: 2- 07-2017

Chamber wall Clean and Coat: 15-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating)

Recipe: 1.4mT, 125/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.3/12.7/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate (open area): 0.75  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =7.7

Etch Profile





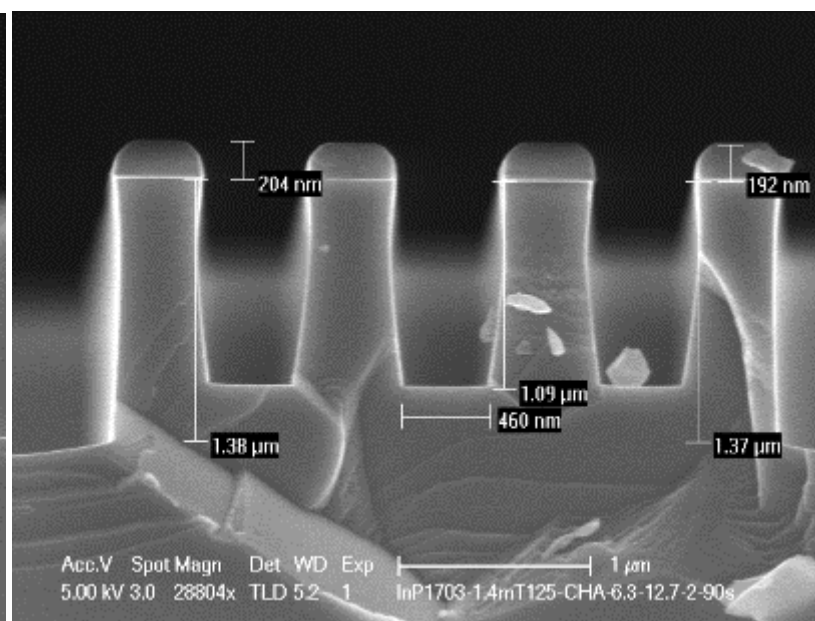
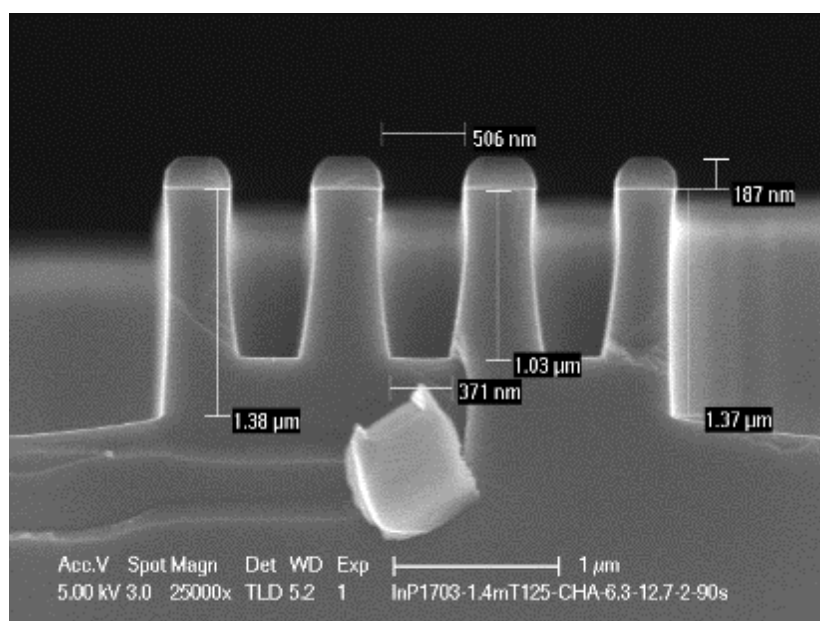
14) Test Date: 2- 21-2017

Chamber wall Clean and Coat: 15-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating)

Recipe: 1.4mT, 125/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.3/12.7/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate (open area): 0.91  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =11.3

Etch Profile



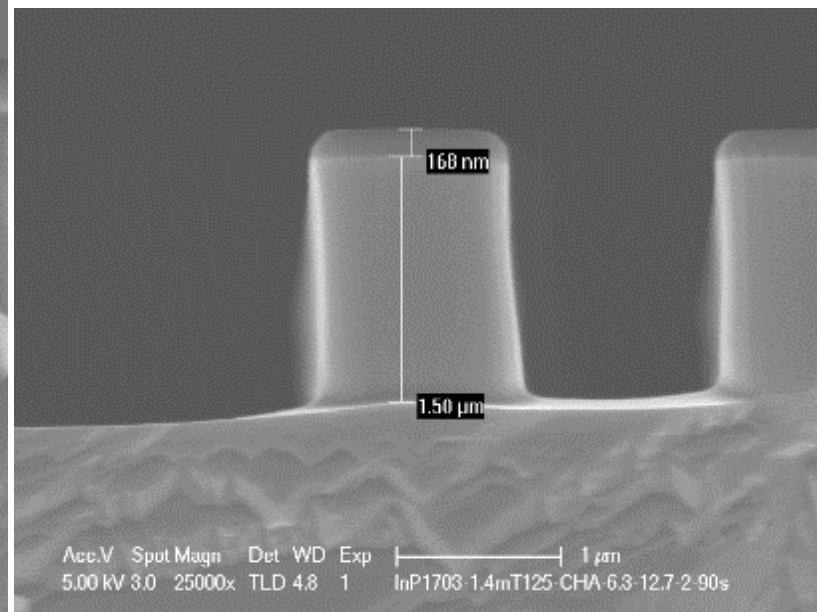
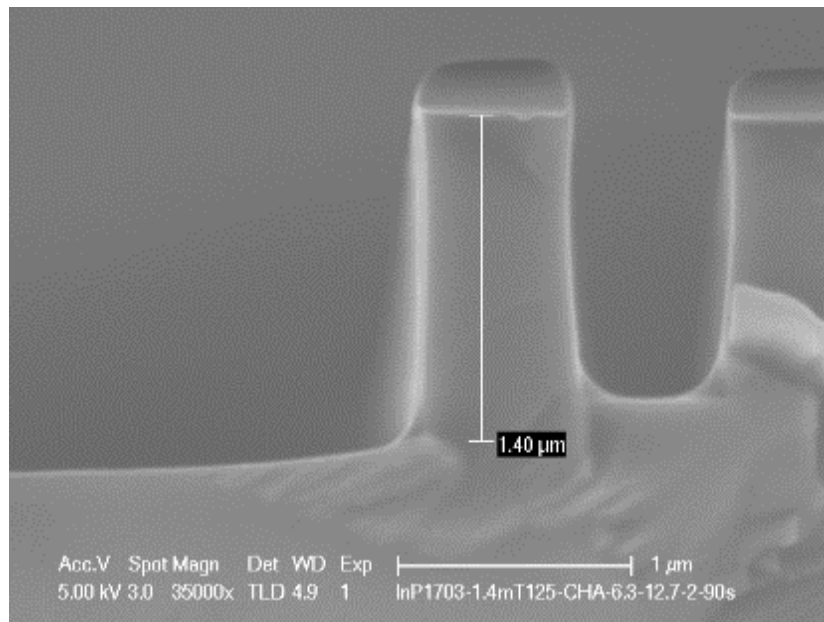
15) Test Date: 3- 21-2017

Chamber wall Clean and Coat: 30-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating)

Recipe: 1.4mT, 125/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.3/12.7/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate (open area): 1.01  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =11.3

Etch Profile



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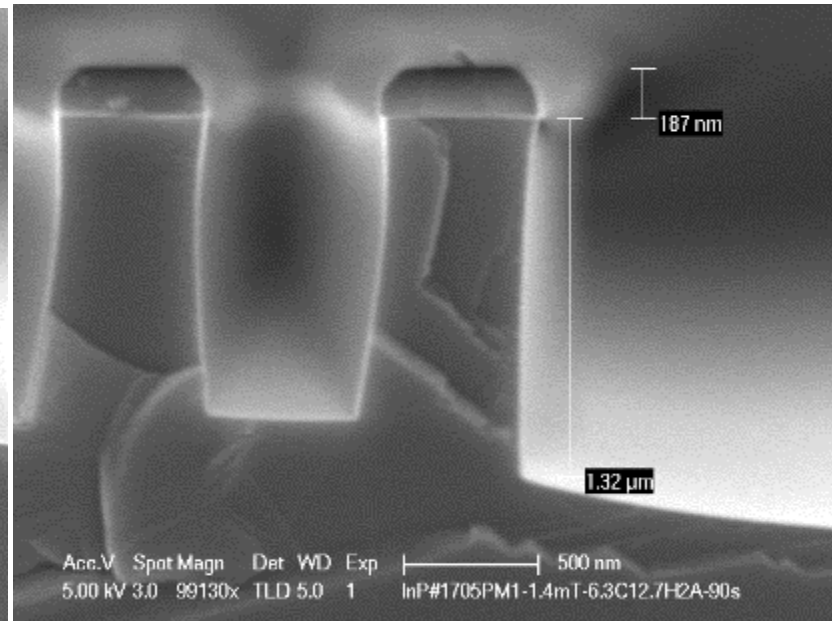
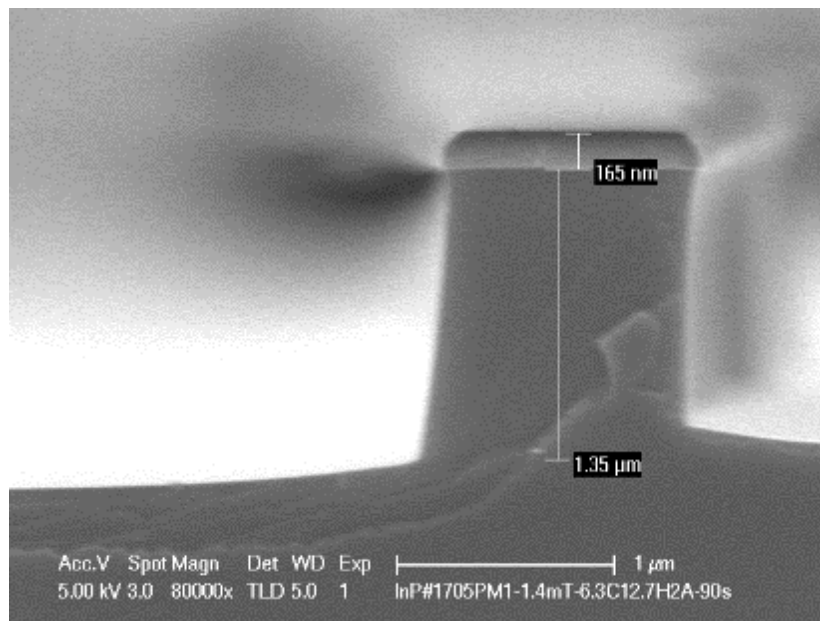
16) Test Date: 4- 20-2017

Chamber wall Clean and Coat: 30-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating)

Recipe: 1.4mT, 125/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.3/12.7/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate (open area): 0.88  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =10.2

Etch Profile



Ning Cao, Staff Engineer, Nano-fabrication Lab, UCSB

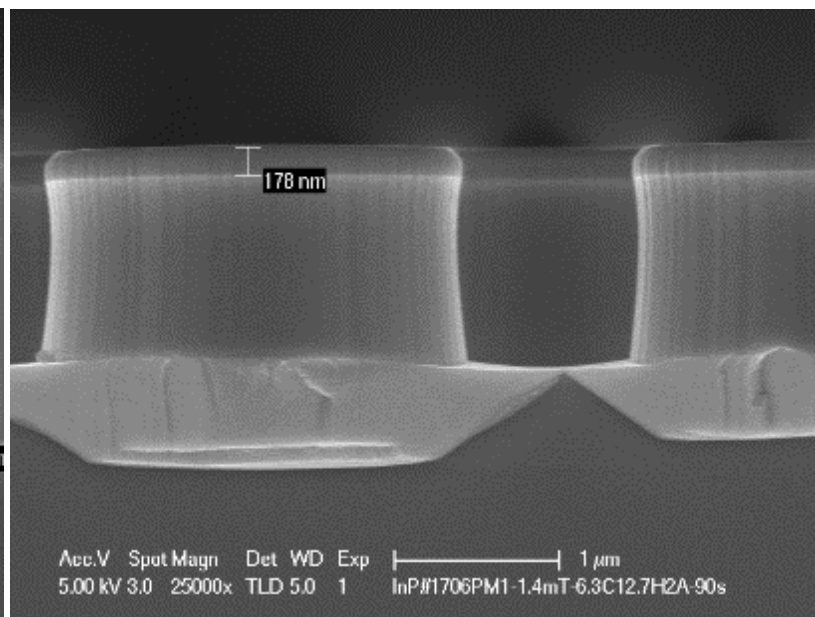
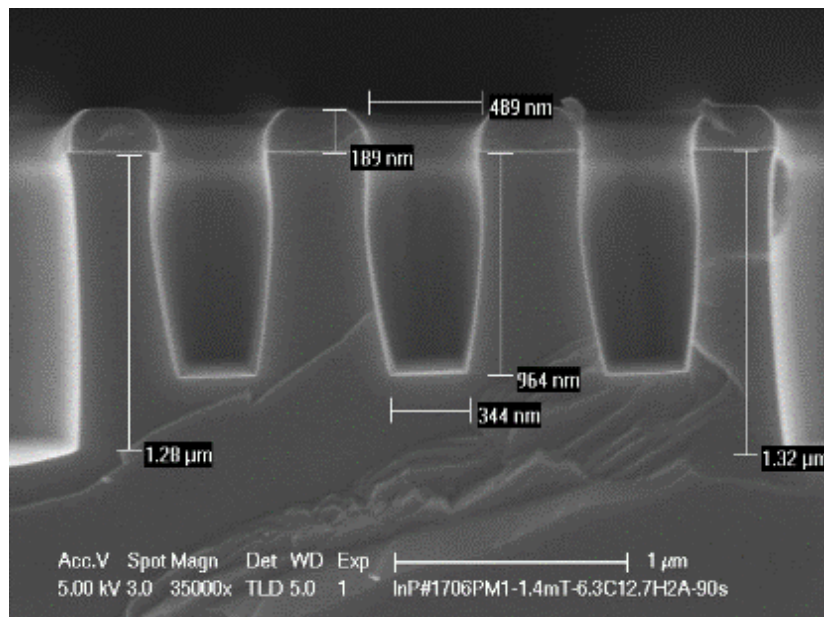
17) Test Date: 5-04-2017

Chamber wall Clean and Coat: 30-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating)

Recipe: 1.4mT, 125/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.3/12.7/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate (open area): 0.84  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =11.0

Etch Profile



Ning Cao, Staff Engineer, Nano-fabrication Lab, UCSB

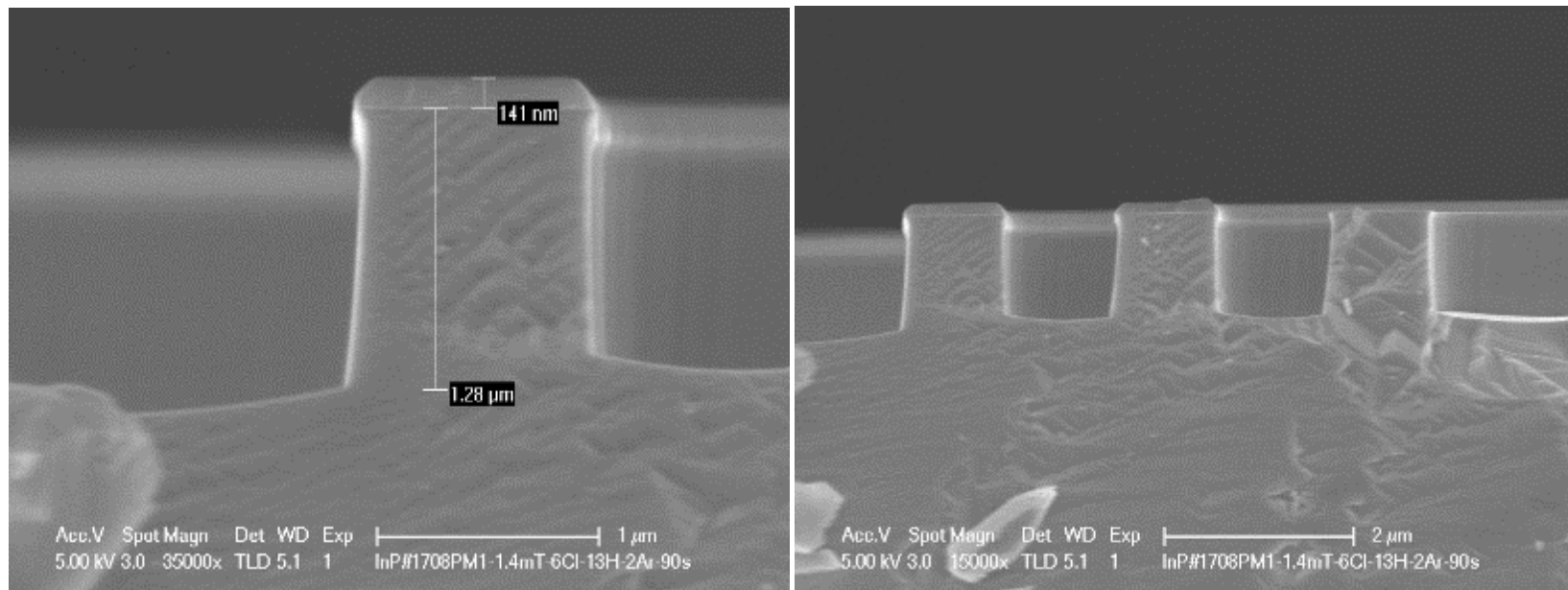
17) Test Date: 6-2-2017

Chamber wall Clean and Coat: 30-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating)

Recipe: 1.4mT, 125/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6/13/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate (open area): 0.81  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =8.6

Etch Profile



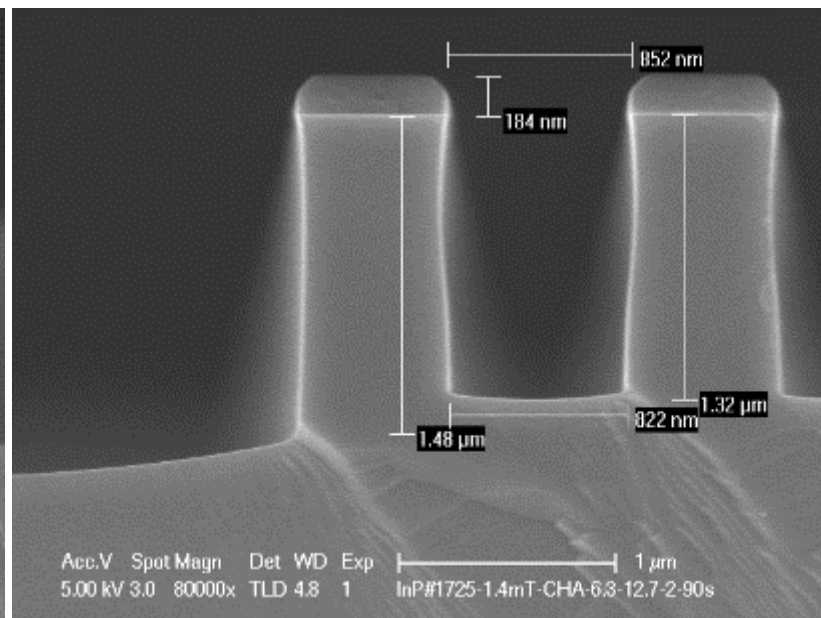
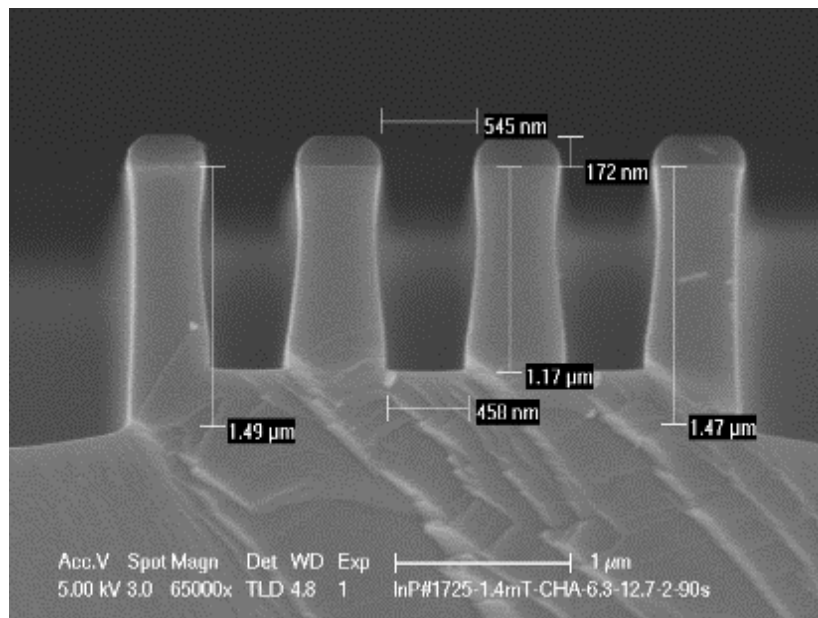
18) Test Date: 7-6-2017

Chamber wall Clean and Coat: 30-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating)

Recipe: 1.4mT, 125 (159v)/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.3/12.7/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate (open area): 0.98  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =12.1

Etch Profile



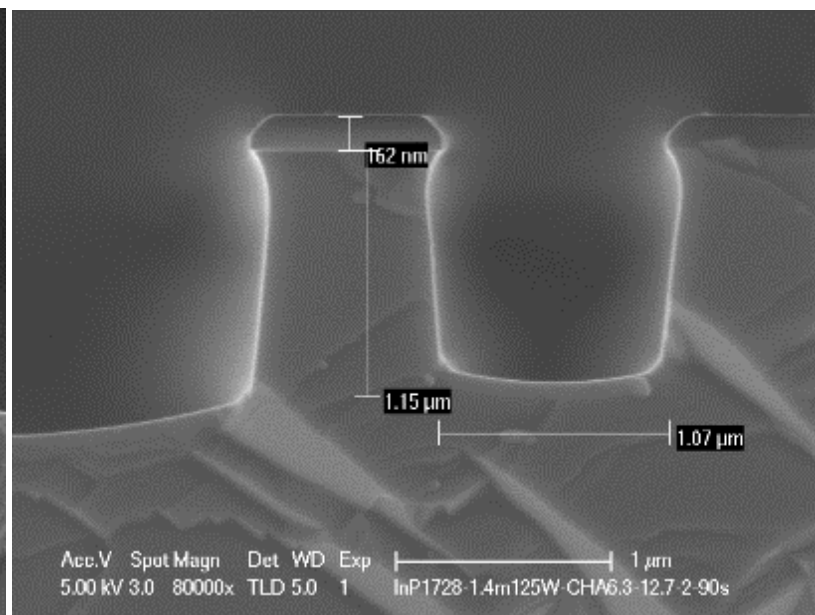
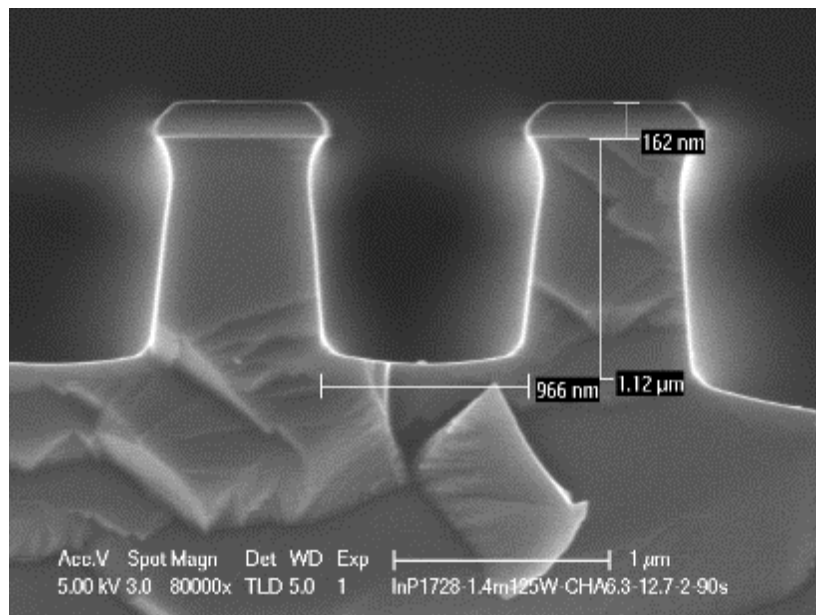
19) Test Date: 8-16-2017

Chamber wall Clean and Coat: 30-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating)

Recipe: 1.4mT, 125 (159v)/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.3/12.7/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate (open area): 0.76  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =8.0

Etch Profile



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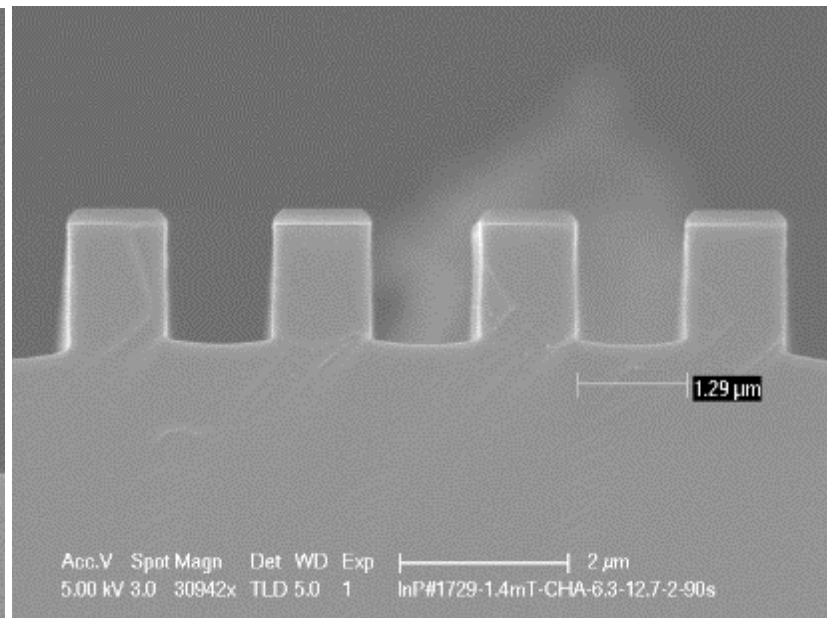
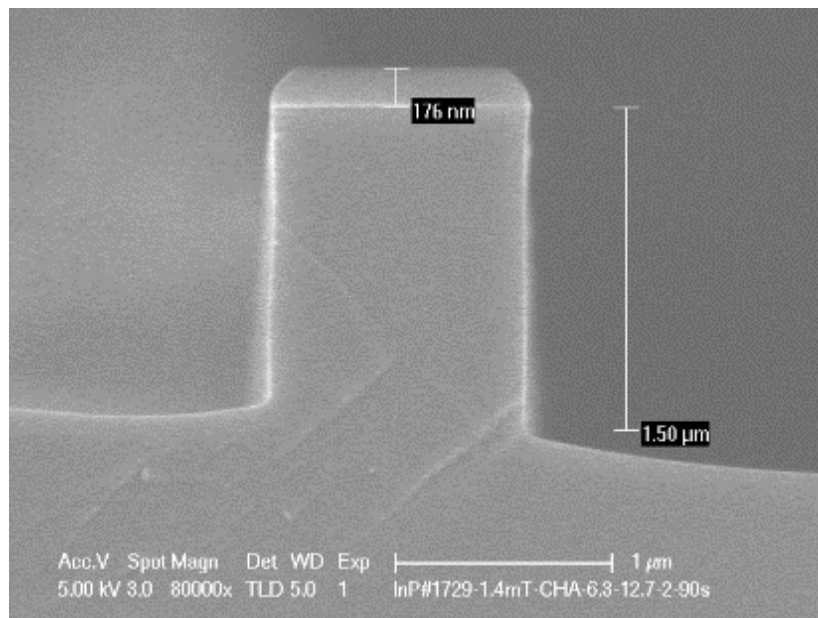
20) Test Date: 8-28-2017

After Tony wet cleaned the PM1 chamber, I did the chamber dry clean and coating: 15-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating).

Recipe: 1.4mT, 125(176V)/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.3/12.7/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate (open area): 1.00  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =11.7

Etch Profile





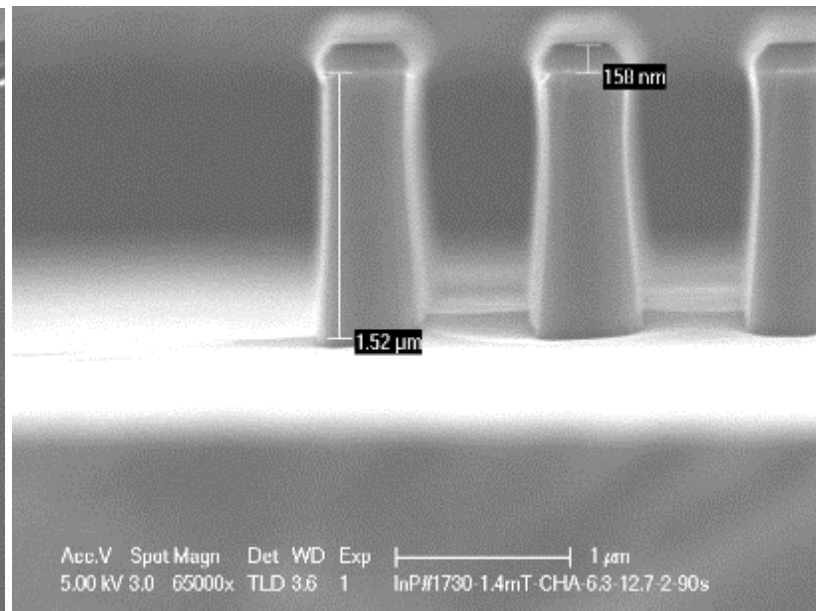
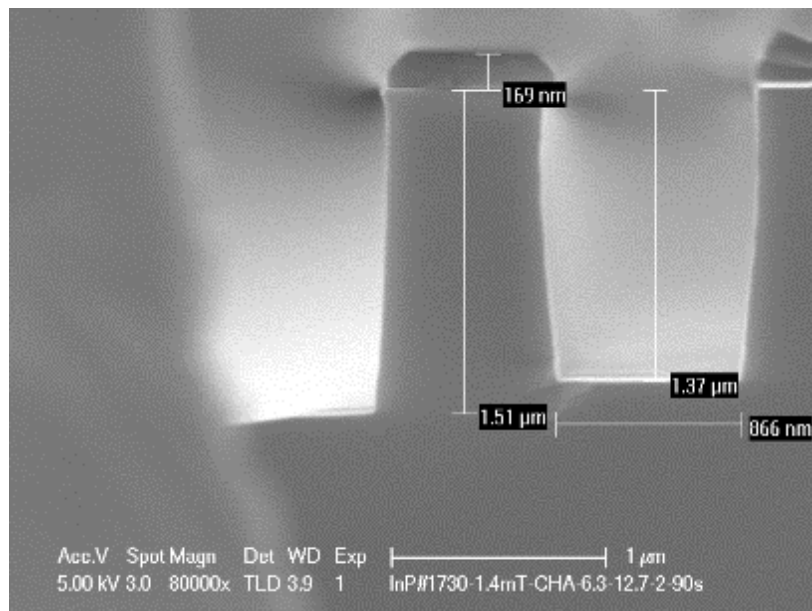
21) Test Date: 10-11-2017

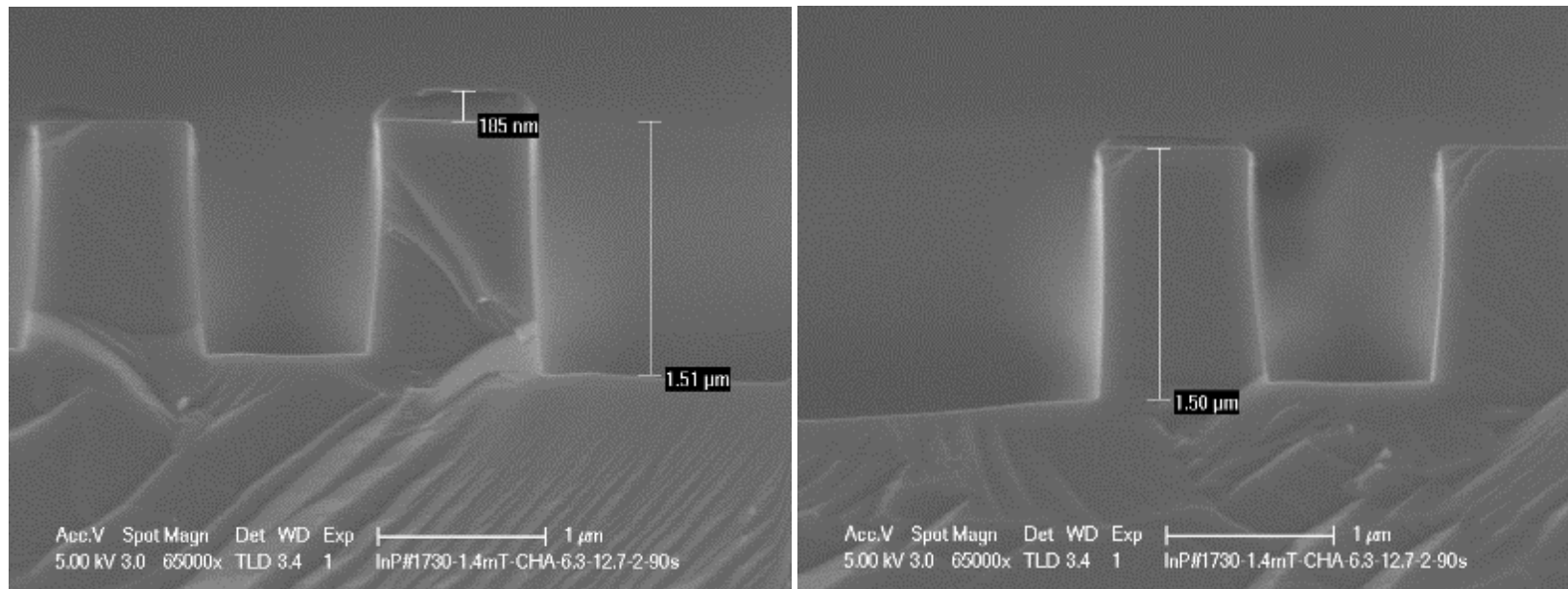
The chamber was dry cleaned and coated: 15-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating).

Recipe: 1.4mT, 125(176V)/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.3/12.7/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate (open area): 1.00  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =11.0

Etch Profile





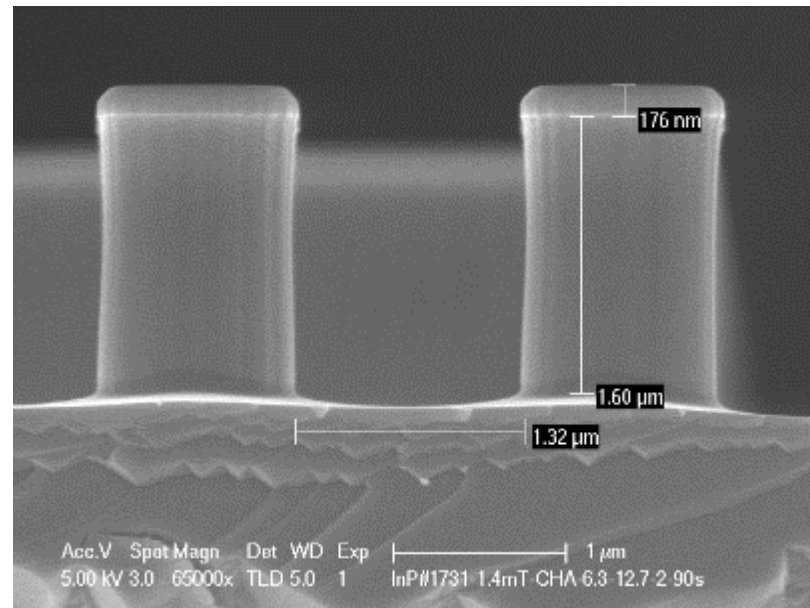
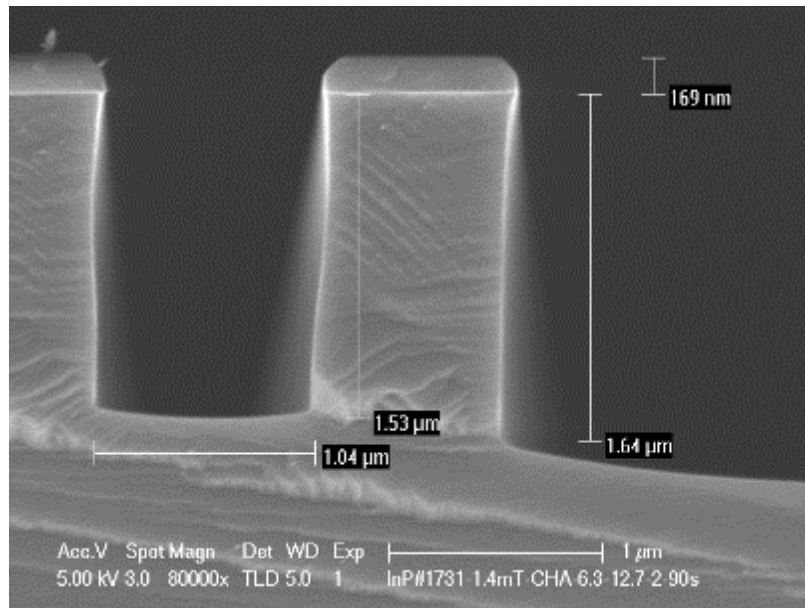
22) Test Date: 10-23-2017

The chamber was dry cleaned and coated: 15-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating).

Recipe: 1.4mT, 125(176V)/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.3/12.7/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate (open area): 1.11  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =13.1

Etch Profile



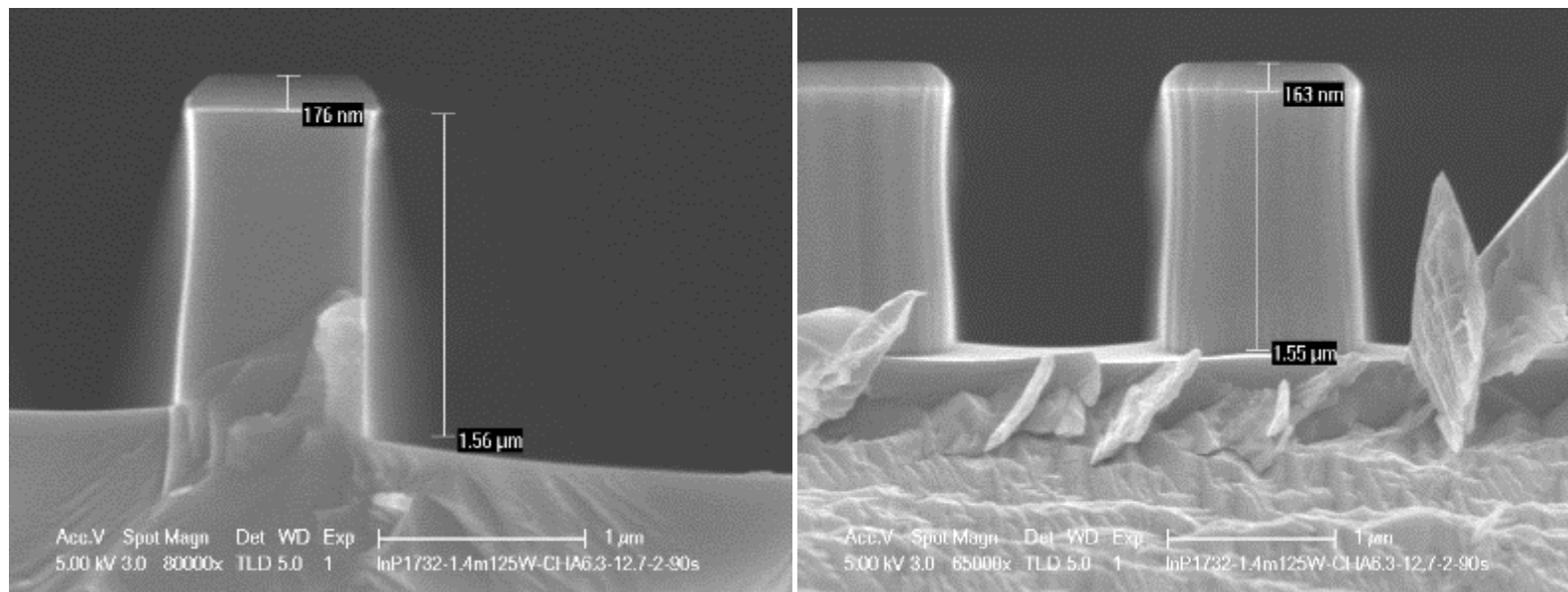
23) Test Date: 11-21-2017

The chamber was dry cleaned and coated: 15-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating).

Recipe: 1.4mT, 125(176V)/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.3/12.7/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate (open area): 1.04  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =12.1

Etch Profile



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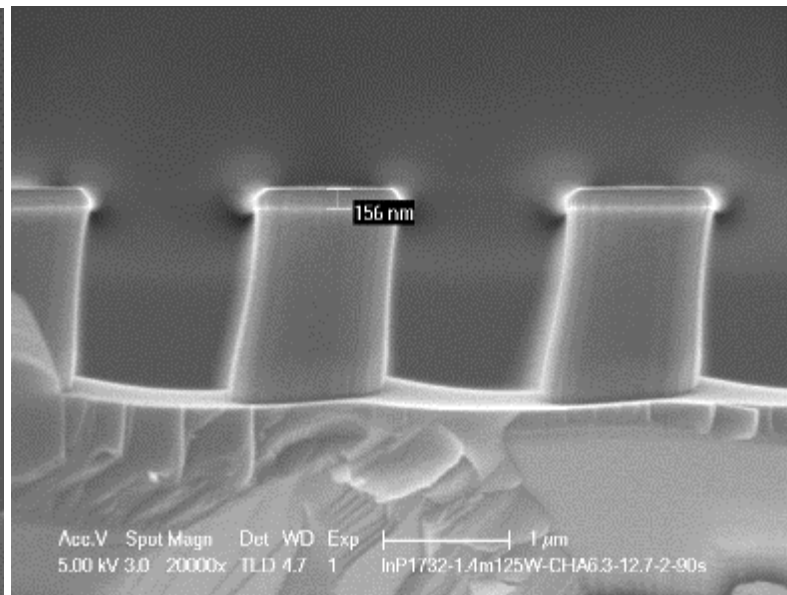
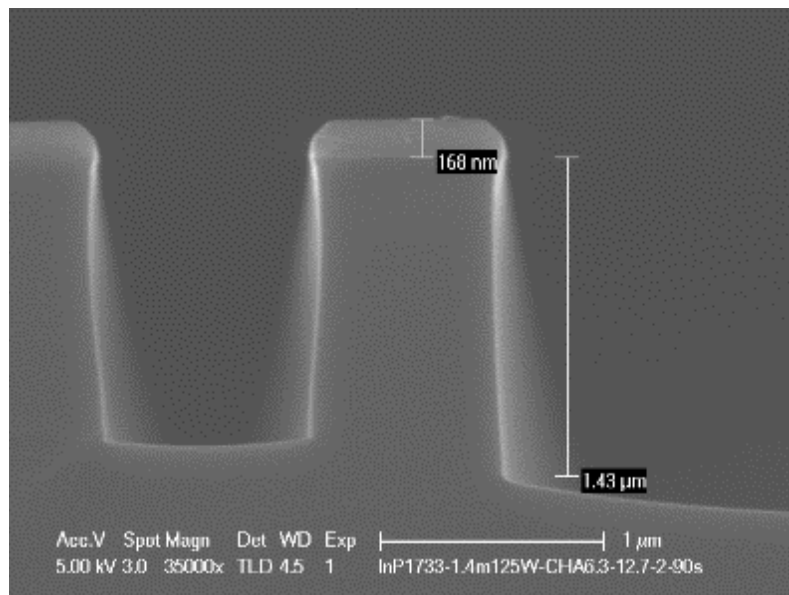
24) Test Date: 12-7-2017

The chamber was dry cleaned and coated: 15-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating).

Recipe: 1.4mT, 125(176V)/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.3/12.7/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate (open area): 0.96  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =10.4

Etch Profile



Ning Cao, Staff Engineer, Nano-fabrication Lab, UCSB

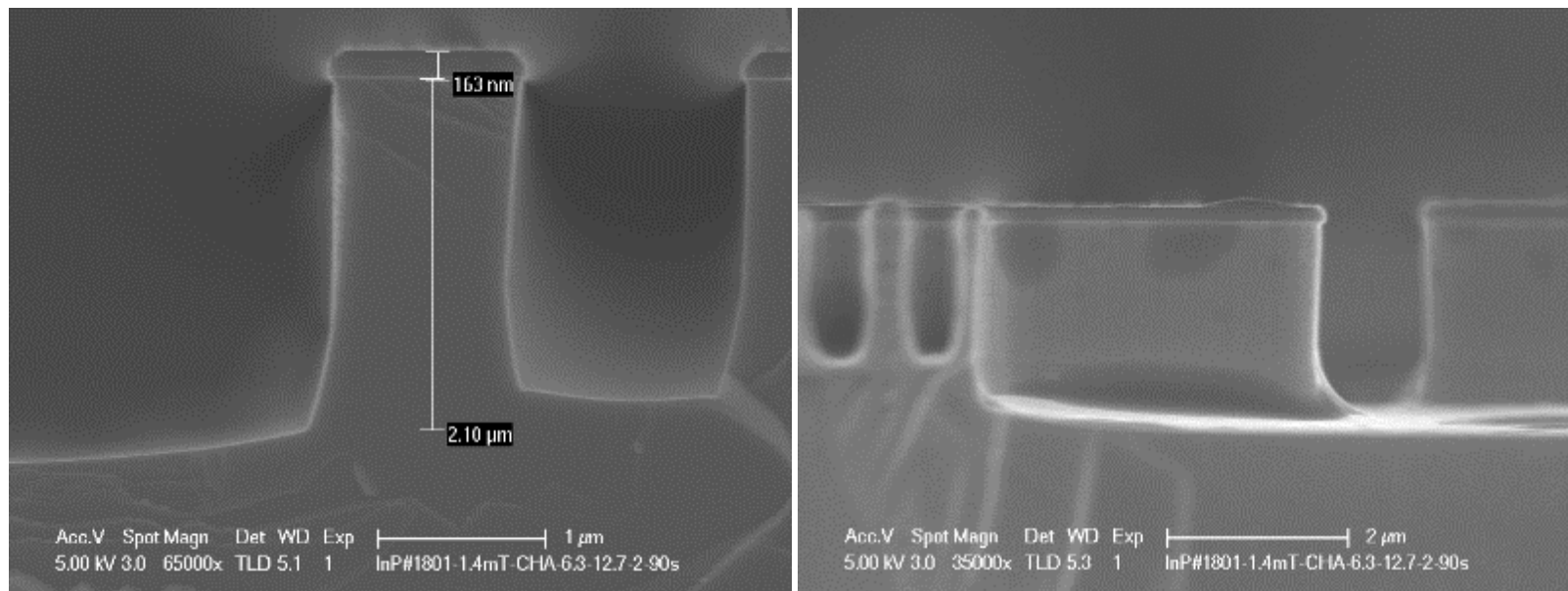
25) Test Date: 1-02-2018

The chamber was dry cleaned and coated: 15-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating).

Recipe: 1.4mT, 125(176V)/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.3/12.7/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate (open area): 1.44  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =14.3

Etch Profile



Ning Cao, Staff Engineer, Nano-fabrication Lab, UCSB

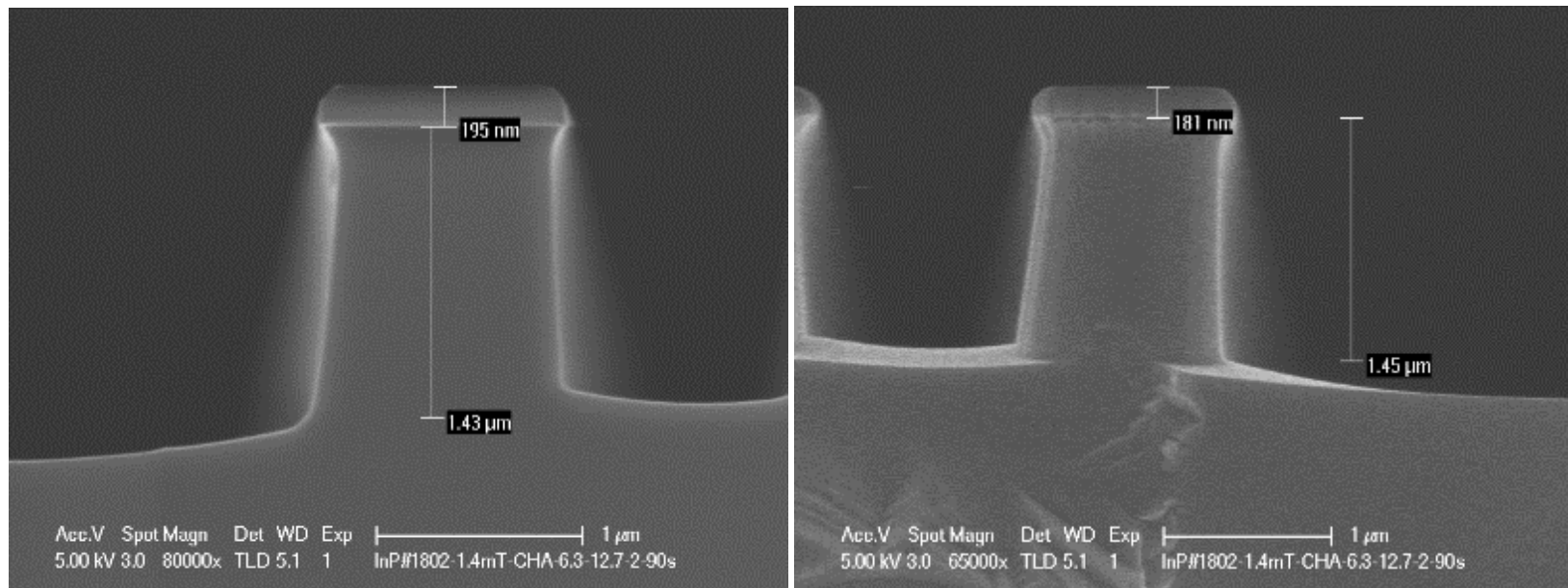
26) Test Date: 3-01-2018

The chamber was dry cleaned and coated: 15-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating).

Recipe: 1.4mT, 125(176V)/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.3/12.7/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate (open area): 0.96  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =9.0

Etch Profile



Ning Cao, Staff Engineer, Nano-fabrication Lab, UCSB

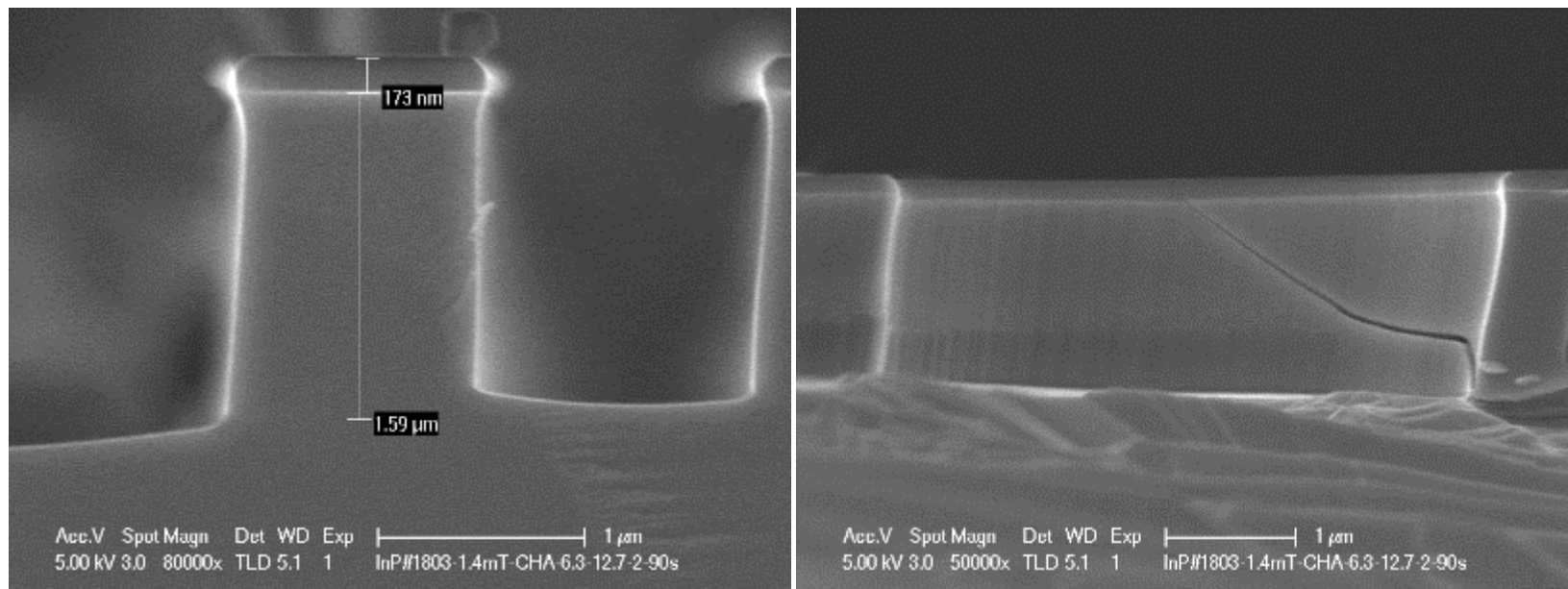
27) Test Date: 4-05-2018

The chamber was dry cleaned and coated: 15-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating).

Recipe: 1.4mT, 125(157V)/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.3/12.7/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate (open area): 1.05  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =11.9

Etch Profile





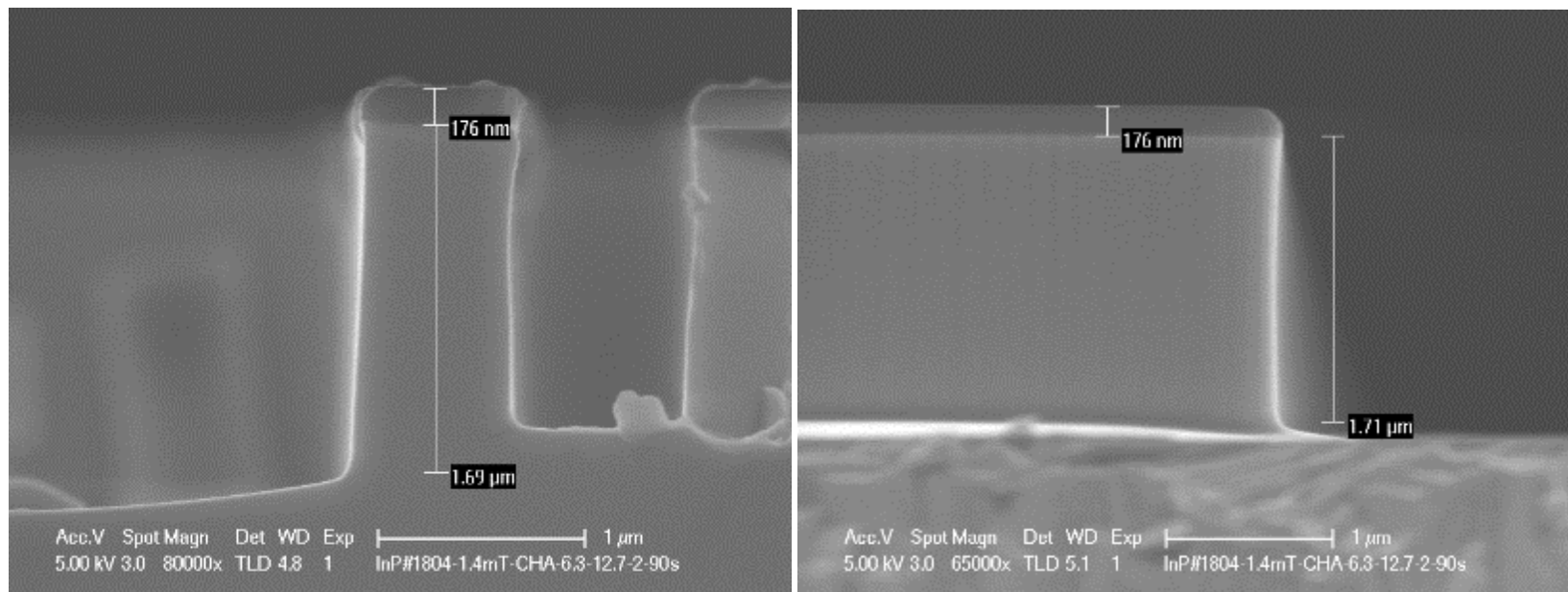
28) Test Date: 4-10-2018

The chamber was dry cleaned and coated: 15-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating).

Recipe: 1.4mT, 125(157V)/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.3/12.7/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate (open area): 1.12  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =12.8

Etch Profile



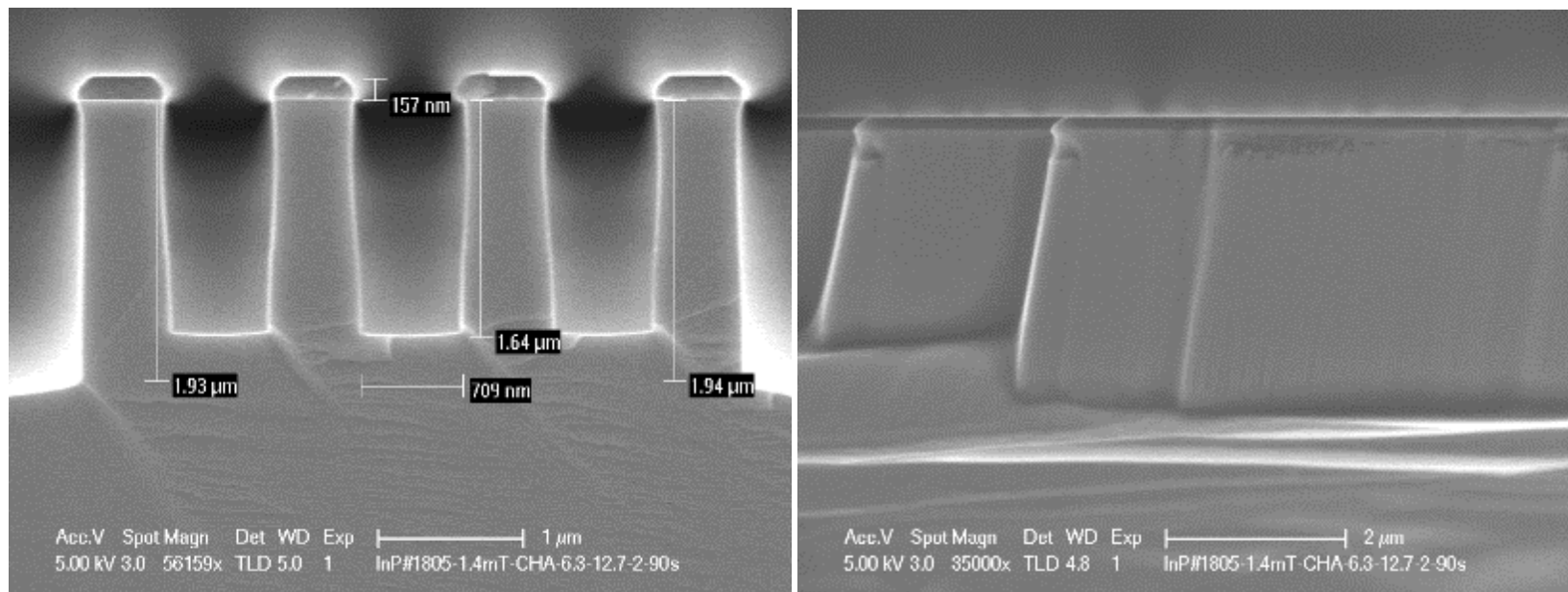
29) Test Date: 4-26-2018

The chamber was dry cleaned and coated: 15-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating).

Recipe: 1.4mT, 125(157V)/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.3/12.7/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate (open area): 1.29  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =13.6

Etch Profile



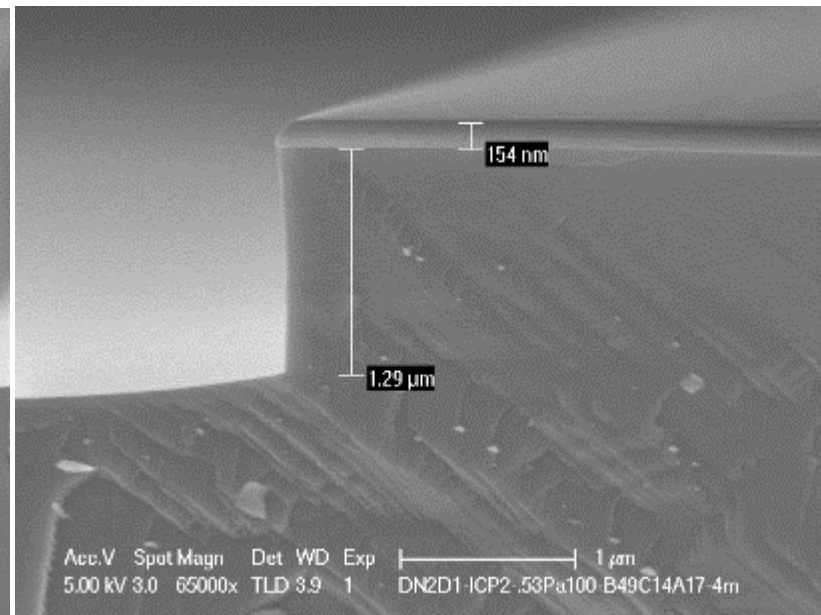
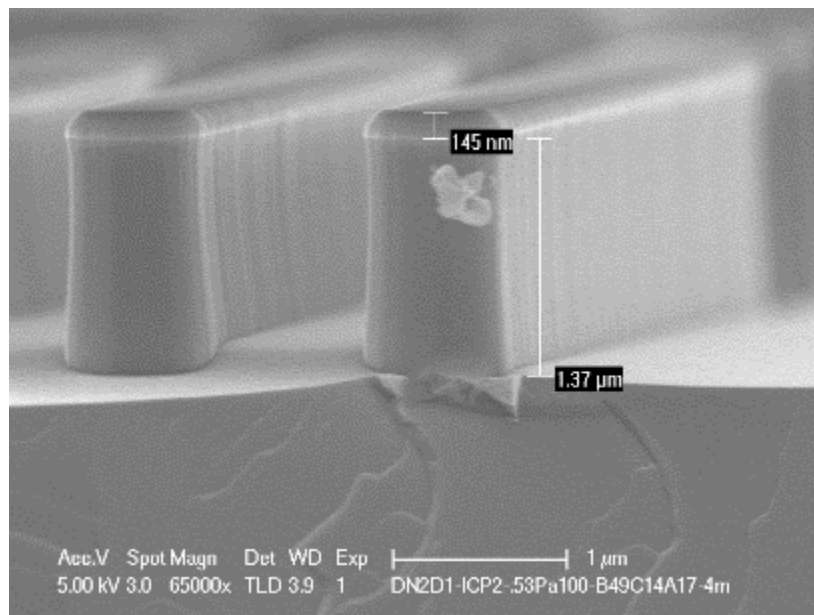
30) Test Date: 5-22-2018

The chamber was dry cleaned and coated: 15-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating).

Recipe: 1.4mT, 125(157V)/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.3/12.7/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate (open area): 0.88  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =8.4

Etch Profile



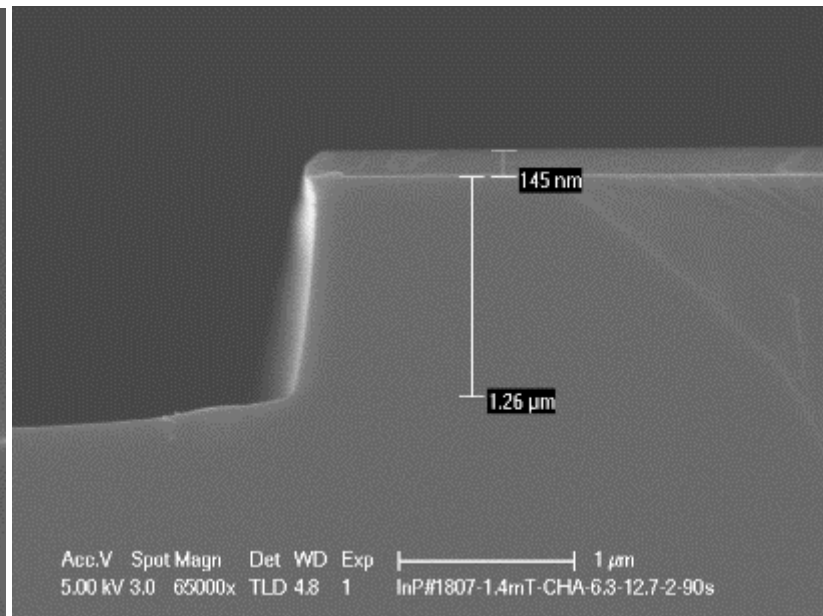
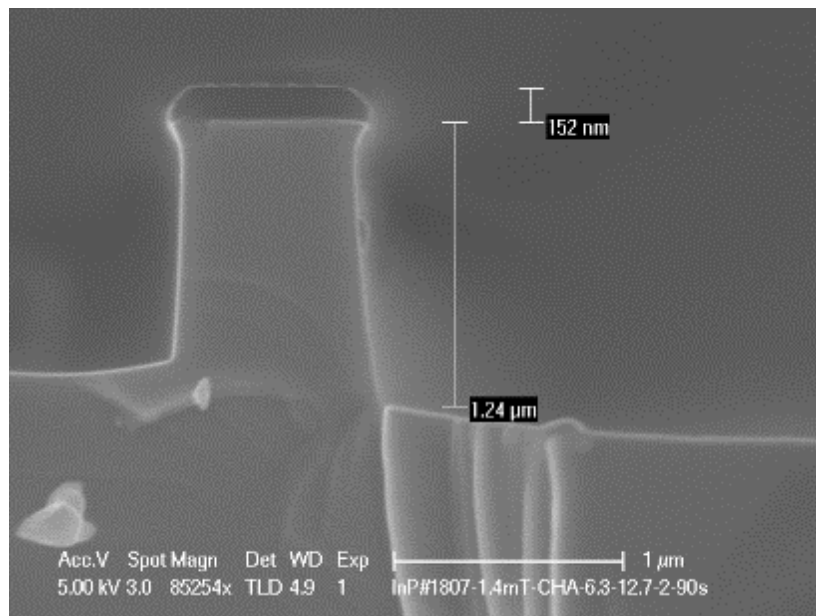
31) Test Date: 8-7-2018

The chamber was dry cleaned and coated: 15-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating).

Recipe: 1.4mT, 125(173V)/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.3/12.7/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate (open area): 0.81  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =8.0

Etch Profile



Ning Cao, Staff Engineer, Nano-fabrication Lab, UCSB

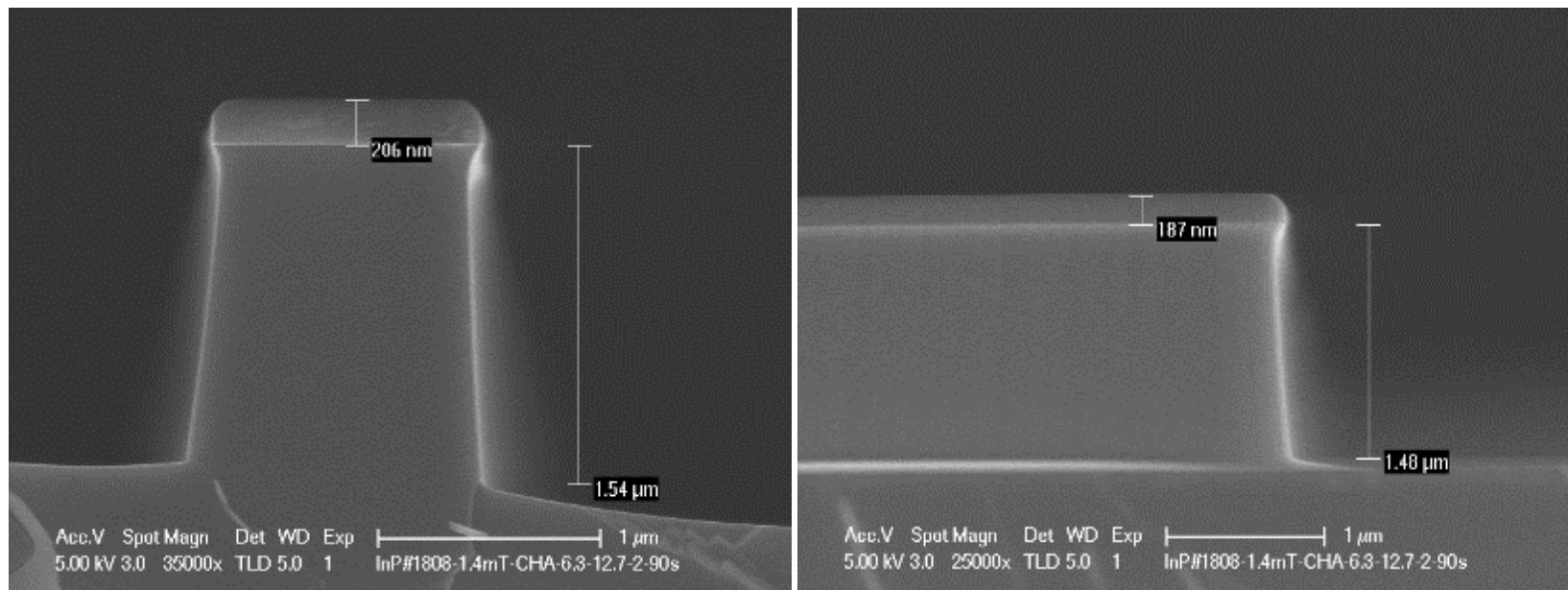
32) Test Date: 10-3-2018

The chamber was dry cleaned and coated: 15-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating).

Recipe: 1.4mT, 125(163V)/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.3/12.7/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate (open area): 1.01  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =13.7

Etch Profile



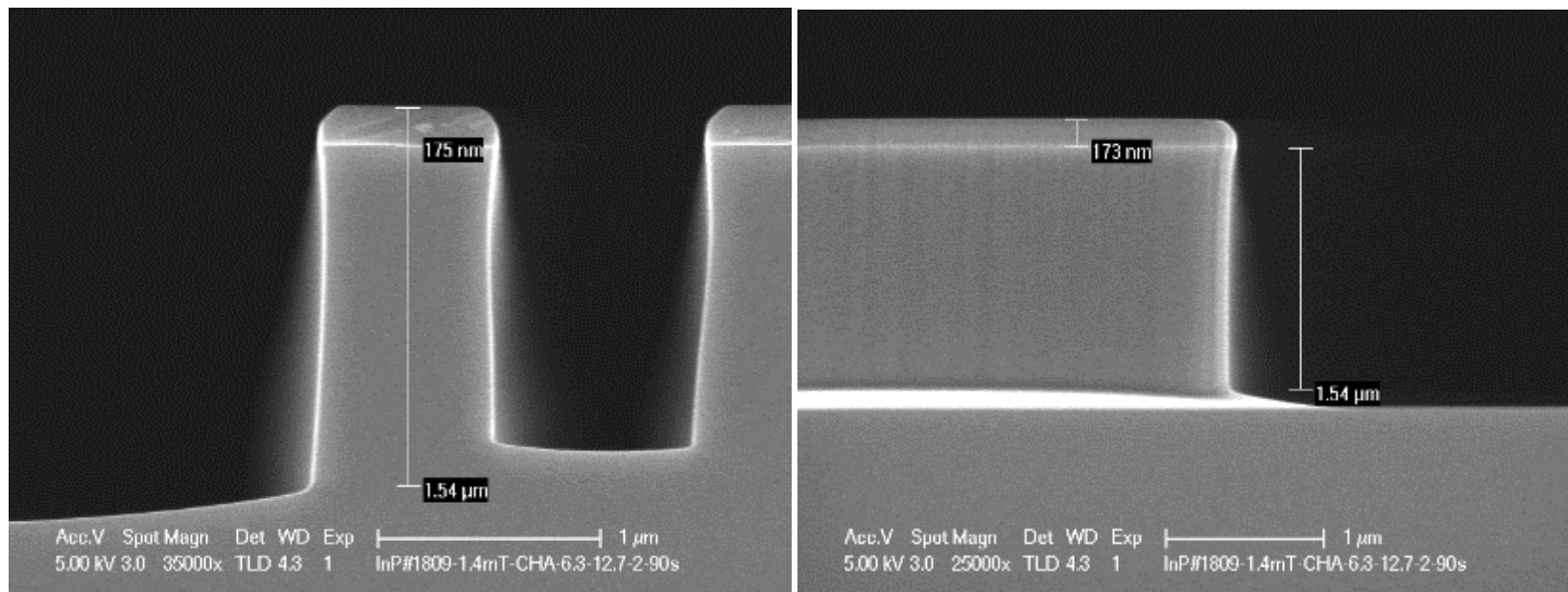
33) Test Date: 12-10-2018

The chamber was dry cleaned and coated: 15-minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating).

Recipe: 1.4mT, 125(163V)/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.3/12.7/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate (open area): 1.01  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =11.4

Etch Profile



34) Test Date: 1-31-2019

The chamber was dry cleaned and coated: 30minute O<sub>2</sub> plasma clean and 15-minute Coat using the same recipe (a quarter InP was inside of the chamber during coating).

Recipe: 1.4mT, 125(158V)/800W, Cl<sub>2</sub>/H<sub>2</sub>/Ar=6.3/12.7/2 sccm (the sample was glued to Si carrier using High-vacuum thermal grease)

Etch rate (open area): 0.88  $\mu\text{m}/\text{min}$ ; Etch selectivity (InP/SiO<sub>2</sub>) =9.7

Etch Profile

