

NNCI Dry Etch Capabilities

| <u>NNCI Site</u> | <u>Tool</u> | <u>Type</u> | <u>Gases</u> | <u>Application</u> | <u>Wafer size</u> |
|------------------|---|---------------|--|---|-------------------------------|
| Cornell | Plasmatherm | | SF6, C4F8, O2, Ar | Deep silicon etch | 100mm |
| | Versaline | ICP | | Deep Ge etch | |
| | DSEIII | | | SOI | |
| Cornell | Unaxis 770 | ICP | SF6, C4F8, O2, Ar | Deep silicon etch Mixed silicon etch Release | 100mm 150mm |
| Cornell | Ptherm 770 left chamber right chamber | ICP | Cl2, BCl3, SF6, O2, N2, | metal etch | 100mm |
| | | | Cl2, BCl3, O2, H2, Ar | III-Vs | 100mm |
| | | | SiCl4, SF6 CH4 | III-nitrides | |
| Cornell | Oxford 100 | ICP | CF4, CHF3, C2F6, C4F8 C4F6, CH2F2, SF6, Ar O2, N2, CO2 gas ring | silicon based dielectrics SiO2, Si3N4 quartz, fused silica | 100mm |
| Cornell | Trion Minilock III | ICP | Cl2, BCl3, O2, Ar, CHF3 N2 | chrome etch | 100mm |
| | | | | | 150mm |
| | | | | | 200mm |
| Cornell | Oxford 100 Cobra | ICP | HBr, Cl2, CH3OH, O2, H2, SF6, Ar, BCl3 | shallow silicon etch | 100mm |
| | | | | magnetics etch | |
| | | | | cryogenic Si etch [F] based metal etch diamond etch | |
| Cornell | Plasmatherm 720/740 left chamber | RIE | Cl2, BCl3, O2, CH4, N2 SF6, Ar | Au exposure | up to 200mm |
| | | right chamber | | RIE | Cl2, BCl3, O2, CF4, SF6 Ar |
| Cornell | Oxford 80+ Plasmalab 1 | RIE | CF4, CHF3, SF6, Ar, H2 O2 | Si, SiO2, SiN Ta, polymers | up to 200mm |
| Cornell | Oxford 80+ Plasmalab 2 | RIE | CF4, CHF3, SF6, Ar, H2 O2 | Si, SiO2, SiN | up to 200mm CMOS only |
| Cornell | Plasmatherm | 72 RIE | CF4, CHF3, SF6, H2 O2 | Si, SiO2, SiN W, Ta, polymers | |
| Cornell | Xactix-XetchX3 | Release | XeF2, N2 | Silicon | up to 150mm |

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|------------------|------------------|-----------------------|--|---|-------------------|
| Cornell | Primaxx uetch | Release | HF, MeOH, N2 | Silicon oxide | up to 200mm |
| Cornell | AJA | Ion Mill | Argon | many materials | up to 150mm |
| Cornell | Aura 1000 | PR strip | O2 | PR strip | up to 150mm |
| | Glenn 1000 | PR strip | O2 | | up to 200mm |
| | Yes CV200RFS | PR strip | O2 | | up to 200mm |
| | Anatech | PR strip | | | up to 150mm |
| | | Bosch polymer removal | | | |
| Harvard | Oxford Cobra | ICP | | Si cryo etch metal etch magnetics polymers | |
| Harvard | Unaxis 770 | ICP | HBr, Cl2, BCl3, CH4, H2, Ar, O2, N2 | III-V's 200C diamond | up to 150mm |
| Harvard | STS-LPX | ICP | SF6, C4F8, CHF3, O2, Ar, Cl, HBr, CF4, BCl3 H2 | Si, Si dielectrics, BN, SiC, graphene | up to 150mm |
| Harvard | STS Rapier | ICP | SF6, C4F8, O2, Ar N2 | deep silicon etch | up to 150mm |
| Harvard | South Bay | RIE | SF6, CHF3, CF4, Ar,O2 | silicon silicon based dielectrics | up to 150mm |
| Harvard | Ulvac-570 | NLD | SF6, CF4, CHF3, C4F8, O2, Ar, Cl2 | Si dielectrics, TiO2, LiNbO3, Al2O3 | |
| Harvard | PT Versaline | ICP | BCl3, Cl2, HBr, CH4 O2, Ar | diamond | 100mm |
| Harvard | Intlvac | IBE | Ar, O2 | diamond, noble metals, oxides | up to 150mm |
| Harvard | Anatech 1 | PR strip | O2 | PR strip | up to 150mm |
| | Anatech 2 | PR strip | O2 | PR strip | up to 150mm |
| | Samco | PR strip | UV /O3 | PR strip | |
| | Matrix | PR strip | O2 | PR strip | |
| | Technics | PR strip | O2 | PR strip | |

NCCI Dry Etch Capabilities

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|------------------|---------------------------|-------------|--------------------------------------|-----------------------------------|-------------------|
| Stanford | Plasmatherm Versaline DSE | ICP | SF6, C4F8, O2, Ar | deep silicon etch SOI | 100mm |
| Stanford | Plasmatherm Versaline | ICP | Cl2, BCl3, SF6, CF4, CH4, O2, Ar, N2 | metals | up to 150mm |
| Stanford | Plasmatherm Versaline | ICP | C4F8, CHF3, CF4, H2, Ar, O2, N2, He | silicon based dielectrics | 100mm |
| Stanford | Oxford 100 Cobra | ICP | BCl3, Cl2, HBr, CH4, SF6, O2, Ar, N2 | H2 III-V's II-VI's | 100mm |
| Stanford | Oxford 80 | RIE | CHF3, CF4, SF6, Ar, O2 | Silicon Si dielectrics | up to 200mm |
| Stanford | Oxford 100 | RIE | CHF3, CF4, SF6, O2, Ar, N2 | Si, SiC dielectrics | 100mm |
| Stanford | Lam 9400 | TCP | HBr, Cl2, CF4, C2F6, O2, N2, H2 | silicon poly-silicon | 100mm |
| Stanford | STS Multiplex Pro ASE | ICP | SF6, C4F8, O2 | deep silicon etch SOI | 100mm |
| Stanford | AMAT P5000 chamber 1 | MRIE | Cl2, BCl3, CF4, Ar, N2 | aluminum silicon | 100mm |
| | chamber 2 | | CHF3, CF4, Ar, He, O2, N2 | Silicon based dielectrics | 100mm |
| | chamber 3 | | Cl2, HBr, NF3, CF4, SF6, He/O2 | silicon poly silicon | 100mm |
| Stanford | AMAT 8100 | Hex RIE | CHF3, SF6, NF3, Ar, O2 | silicon silicon based dielectrics | 100mm |
| Stanford | Drytek-100 | RIE | CF4, SF6, CHClF2, O2 | Si, Si dielectrics, W, Ti | up to 150mm |

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|------------------|-------------------------|-------------|--|---|-------------------|
| Stanford | Gasonics | PR strip | O2 | PR strip | 100mm |
| | Matrix | PR strip | O2 | PR strip | 100mm |
| Stanford | SPTS microetch | Vapor HF | HF, EtOH, N2 | SiO2 | 200mm |
| Stanford | Xactix | XeF2 | XeF2, N2 | Si, Ge, SiGe | 150mm |
| Stanford | Intlvac | ion mill | Ar | varied materials | up to 100mm |
| Georgia Tech | STS-AOE | ICP | C4F8, SF6, O2, H2, CF4 | SiO2, quartz, pyrex, fused silica, Si, SiN | 150mm |
| Georgia Tech | STS ASE | ICP | C4F8, SF6, O2, Ar | deep silicon etch SOI | 100mm |
| Georgia Tech | STS Pegasus | ICP | C4F8, SF6, O2, Ar | deep silicon etch | 150mm |
| Georgia Tech | STS HRM | ICP | C4F8, SF6, O2, Ar, CO2 | deep silicon etch SOI | 150mm |
| Georgia Tech | Plasmatherm 770 SLR | ICP | | | |
| | right chamber | | C4F8, SF6, O2, Ar | deep silicon etch | up to 150mm |
| | left chamber | | Cl2, BCl3, C4F8, CF4, H2, Ar, O2 | III-V's, SiO2, SiN Al, other metals | 100mm |
| Georgia Tech | STS-SOE | ICP | Cl2, BCl3, HBr, CHF3 CH4, H2, CF4, Ar, O2, N2 | shallow silicon III-V's | 100mm |
| Georgia Tech | Oxford Cryogenic 100 | ICP | Cl2, BCl3, SF6, CHF3, CO2, C4F8, H2, Ar, H2 He | Silicon silicon based dielectrics metals | 100mm |
| Georgia Tech | Plasmatherm 790 RIE | | | | |
| | left chamber | | Cl2, BCl3, O2, Ar | III-V's, silicon Al, Cr, metals | up to 200mm |
| | right chamber | | CHF3, CF4, SF6, O2, Ar | Si, SiO2, SiN, SU8, BCB, polyimide | 4-100mm |

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|--------------------------|---|---------------------------------------|--------------------------------------|--|--|
| Georgia Tech | Plasmatherm | 720 RIE | Cl2, BCl3, O2, H2, Ar | III-V's, Al, Cr, Ti, Si | up to 200mm |
| Georgia Tech | Unaxis | RIE | Cl2, O2, Ar, BCl3 | shallow silicon | 3-100mm |
| Georgia Tech | Oxford 80 Plasmalab Endpoint | RIE | CF4, CHF3, Ar, O2 | silicon based dielectrics | up to 100mm |
| Georgia Tech | Vision 320 | RIE | CF4, SF6, Ar, N2, O2, H2 | silicon silicon based dielectrics | up to 200mm |
| Georgia Tech | Xactix E1 | XeF2 | XeF2 | Si | up to 100mm |
| Georgia Tech | Gasonics Aura 1000 YES LFE Technics Micro | PR strip PR strip barrel RIE | O2 O2 O2 O2, N2 | PR strip PR strip descum/activate descum/activate | up to 150mm up to 200mm up to 100mm up to 100mm |
| Nebraska | Oxford Plasma Pro Estrelas | ICP | C4F8, CHF3, CF4, SF6, O2, Ar | Si deep etch cryo deep etch | up to 100mm |
| Nebraska | Trion Minilock Phantom III | ICP | BCl3, Cl2, CF4, SF6, Ar, O2 | Metals, Si, polymers | up to 300mm |
| Nebraska | Intlvac Nanoquest-I | ion mill | Ar, O2, N2 | varied materials | up to 100mm |
| Nebraska to be added | Intlvac Nanoquest-I | ion mill | Ar, O2, N2 | varied materials | up to 100mm |
| Louisville | Trion Minilock Phantom III | ICP | BCl3, Cl2, CHF3, CF4, SF6, O2, Ar | Si, SiO2, GaAs, GaN, Ti, Al, Au, Pt, Cr | up to 200mm |
| Louisville | March RIE CS 1701 | RIE | CHF3, CF4, H2, O2 | SiO2, Si3N4, PR, Parylene, Polyimide | up to 150mm |
| Louisville Louisville | STS ASE Xactix E2 | ICP Release | SF6, C4F8, Ar, O2 XeF2 | Si deep etch release | 100mm up to 150mm |

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|---------------------------|-----------------------|------------------|--|---|-------------------|
| N.Carolina Chapel Hill | Alcatel AMS100 | ICP | SF6, C4F8, CH4, Ar, He, O2 | Si deep etch Si dielectrics quartz Ti, Ta, W | up to 150mm |
| NCSU-NNF | Trion Minilock III | ICP | BCl3, Cl2, CF4, H2, O2 | Si, Si dielectrics GaAs, Al | up to 200mm |
| NCSU-NNF | Semigroup | RIE | CHF3, SF6, Ar, O2 | Si dielectrics | up to 150mm |
| NCSU-NNF | Plasmatherm | ICP | HBr, Cl2, SF6, Ar, O2 | Si, SiGe | up to 150mm |
| NCSU-NNF | Alcatel AMS100 | ICP | SF6, C4F8, CF4, O2 | Si deep etch | up to 150mm |
| NCSU-NNF | PM-600 | barrel asher | O2 | PR strip | up to 150mm |
| Duke-SMIF | SPTS Pegasus | ICP | SF6, C4F8, Ar, O2 | Si deep etch | up to 150mm |
| Duke-SMIF | Trion Minilock II | ICP | BCl3, Cl2, HBr, SiCl4, CH4, H2, CF4, O2, Ar | III-Vs | up to 125mm |
| Duke-SMIF | Trion Phantom II | ICP | CHF3, CF4, SF6, O2 | Si dielectrics, polymers | up to 200mm |
| U.Penn | Oxford 80 | RIE | CF4, CHF3, SF6, O2, Ar | Si, Si dielectrics, fused silica, quartz, | up to 200mm |
| U. Penn | STPS Rapier | ICP | C4F8, SF6, Ar, O2 | Si deep etch Ge deep etch | 100mm |
| U. Penn | Oxford Cobra | ICP | C4F8, Cl2, BCl3, SF6, O2, Ar | Al2O3, Al, Cr | up to 100mm |
| U. Penn | Technics | RIE | SF6, O2 | varied materials, PR strip | up to 200mm |
| U. Penn | Xactix XeF2 | release | XeF2 | Si isotropic | up to 150mm |
| U. Penn | Anatech 1 | barrel ashing | CF4, O2, Ar, N2 | PR strip, activation | up to 150mm |
| U. Penn | Anatech 2 | barrel ashing | O2 | PR strip, activation | up to 200mm |

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|----------------------------|--|-----------------|---------------------------------------|--|-------------------|
| Minnesota | Plasmatherm SLR 770 | ICP | C4F8, SF6, O2, Ar | deep silicon etch | 100mm |
| Minnesota | Oxford PlasmaLab 100-180 | ICP | CF4, CHF3, SF6, Cl2, BCl3, Ar, N2, O2 | SiN, SiO2, Al2O3, Al, HfO2, ZnO | 100mm |
| Minnesota | Intlvac Nanoquest II | Ion Mill | Ar-22cm | various materials | up to 150mm |
| Minnesota | STS 320 | RIE | CF4, CHF3, SF6, Ar, O2 | silicon and silicon based dielectrics | up to 200mm |
| Minnesota | Advanced Vacuum 320 | RIE | CF4, CHF3, SF6, Ar, N2, CH3OH | silicon, silicon based dielectrics, magnetic materials | up to 200mm |
| Minnesota | Xactix E1 | XeF2 | XeF2, N2 | silicon | up to 150mm |
| Minnesota | Branson | PR strip | O2 | PR strip | |
| Arizona St. | STS ASE | ICP | C4F8, SF6, Ar, O2 | Deep silicon etch | 100mm |
| Arizona St. | STS | ICP | Cl2, BCl3, O2, Ar, CH4, H2 | III-V's and silicon | 100mm |
| Arizona St. | Oxford PlasmaLab 80 | RIE | Cl2, BCl3, O2, N2, Ar, | III-V's, metals | up to 200mm |
| Arizona St. | Oxford PlasmaLab 80 | RIE | CF4, CHF3, SF6, O2, Ar | silicon and silicon based dielectrics | up to 200mm |
| Arizona St. | Oxford PlasmaLab 80 | RIE | CHF3, CF4, SF6, Ar, O2 | silicon and silicon based dielectrics, metals | up to 200mm |
| Arizona St. | Xactix E-1 | XeF2 | XeF2, N2 | silicon | up to 200mm |
| Arizona St. | PT 790 | RIE | F-based chemistry | Si, Si dielectrics Ru, Ni, Nb, polyimide BARC | up to 200mm |
| Arizona St. Arizona St. | PT Apex SLR Tegal 411 Tegal 412 Tegal 512 | ICP PR strip | O2 | PR strip | up to 200mm |

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|------------------|---|-------------|---|---|-------------------|
| Washington | STPS Rapier | ICP | SF6, C4F8, Ar, O2 | Deep Si etch | up to 200mm |
| Washington | Oxford 100 cryo-chuck | ICP-380 | SF6, C4F8, Ar, O2 | deep silicon etch | up to 150mm |
| Washington | Oxford 100 200C | ICP-180 | Cl2, BCl3, SiCl4, SF6, CH4, H2, N2, O2, Ar | silicon III-V's, Ti, Al | 100mm |
| Washington | Oxford 100 cryo-chuck | ICP-180 | SF6, C4F8, CHF3, N2O SiH4, N2, Ar, O2 | silicon silicon based dielectrics, Nb, W, metals, polymers | 100mm |
| Washington | Trion Phantom II | RIE | SF6, CHF3, O2 | silicon silicon based dielectrics | up to 200mm |
| Washington | Advanced Vacuum Vision 300MK2 | RIE | CF4, CHF3, SF6, O2, Ar | silicon silicon based dielectrics | up to 300mm |
| Washington | Advanced Vacuum Vision 300MKII | RIE | CF4, CHF3, SF6, O2, Ar N2 | silicon silicon based dielectrics | up to 300mm |
| Washington | SPTS Primaxx uEtch VHF | release | VHF | silicon dioxide | up to 200mm |
| Washington | SPTS Xactix e2 XeF2 | release | XeF2 | silicon | up to 150mm |
| Washington | Veeco Microetch ion mill | | Argon | many materials | up to 150mm |
| Washington | AutoGlow Barrel Etch Gatan Solarus Femto Plasma Cleaner | PR strip | O2, N2 | PR strip | varied |
| Texas | Plasmatherm Versaline DSE | ICP | SF6, C4F8, O2, H2 | deep silicon etch SOI | 100mm |

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|------------------|-----------------------|--------------|--|------------------------------|-------------------|
| Texas | Trion Oracle chamber1 | ICP | CF4, SF6, CHF3, O2, Ar, N2, He | quartz | up to 200mm |
| | chamber2 | | SO2, CO2, C2H6, Ar, N2, He, O2 | imprint | up to 200mm |
| | chamber3 | | Cl2, CF4, He | chrome | up to 200mm |
| Texas | Oxford 100 | ICP | HBr, Cl2, BCl3, SF6, SiCl4, CH4, H2, O2, N2, Ar | III-V's | up to 100mm |
| Texas | Oxford 80 | RIE | Cl2, CHF3, SF6, CH4, H2, N2, Ar | Si, SiGe, III-V's, polymers | up to 200mm |
| Texas | Plasmatherm 790#1 | RIE | BCl3, SiCl4, CF4, CH4, H2, SF6, O2 | III-V's | 100mm |
| Texas | Plasmatherm 790#2 | RIE | | | up to 200mm |
| | left chamber | | Cl2, HBr, CF4, O2, He | silicon, polysilicon | |
| | right chamber | | CHF3, O2, H2, Ar | silicon oxide | |
| Texas | Plasmatherm Batchtop | RIE | Cl2, HBr, CF4, O2 | Si, SiGe, high k dielectrics | up to 150mm |
| Texas | STS | ICP | HBr, Cl2, CF4, O2, Ar | Si, SiGe, high k | up to 200mm |
| Texas | LAM Exelan 2300 | RIE | C4F8, CF4, HBr, SF6, CHF3, CO, CO2, N2, H2, Ar, O2 | polymers, BCPs | 300mm |
| Montana St. | Oxford 100 | ICP | Cl2, SiCl4, BCl3, SF6, Ar, O2, N2, H2 | cryo Si etch III-Vs | up to 100mm |
| Montana St. | PVA Tepla Ion Wave 10 | barrel asher | O2, Ar | resist removal | |
| Montana St. | March 1703 | | | | |
| U. Chicago | Plasmatherm Versaline | ICP | SF6, C4F8, Ar, O2 | Si deep etch | 100mm |
| U. Chicago | Plasmatherm | ICP | Cl2 | metals, III-Vs | |

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| U. Chicago | Plasmatherm | ICP | fluorine | | |
| U. Chicago | Memsstar Orbis Alpha | release | vapor HF | silicon oxide | up to 200mm |
| U. Chicago | Ion Wave 10 | plasma asher | O2 | resist removal | up to 200mm |
| U. Chicago | YES CV200 | plasma asher | O2 | resist removal | up to 200mm |
| U. Chicago | YES G1000 | asher | O2 | multi-mode ashing | |
| Northwestern | STS Pegasus | ICP | SF6, C4F8, Ar, O2 | Si deep etch | 100mm |
| Northwestern | Samco RIE 10NR | RIE | CF4, CHF3, SF6, O2, Ar, N2 | Si, Si dielectrics | up to 200mm |
| Northwestern | Xactix | release | XeF2, N2 | release, Si etch | up to 100mm |
| UC San Diego | Oxford 100 | ICP | CHF3, C4F8, CF4, Ar, SF6, O2 | Si, SiO2 | up to 150mm |
| UC San Diego | Trion | ICP | SF6, Cl2, BCl3, CF4, CH4, O2, H2, He | III-Vs, oxides, polymers, metals | up to 150mm |
| UC San Diego | Oxford 80 | RIE | Cl2, BCl3, CHF3, CF4, SF6, O2, Ar | oxides, nitrides metals polymers, resist removal | up to 150mm |
| UC San Diego | Plasma Etch 100 | asher | O2 | polymers, resist removal | up to 200mm |
| UC San Diego | Tepla 100 | asher | O2 | resists, polymers | up to 100mm |
| UC San Diego | Xactix | release | XeF2 | release, Si etch | up to 100mm |
| UC San Diego | New III-V to be added | | | | |
| Virginia Tech | Alcatel | ICP | SF6, C4F8, Ar, O2 | Si deep etch | 100mm |
| Virginia Tech | Trion | ICP | CF4, SF6, CHF3, HBr, Cl2, BCl3, SiCl4, O2 | III-Vs, Al2O3, Si dielectrics | up to 200mm |