Introduction of an innovative water based stripping method for thick photoresists

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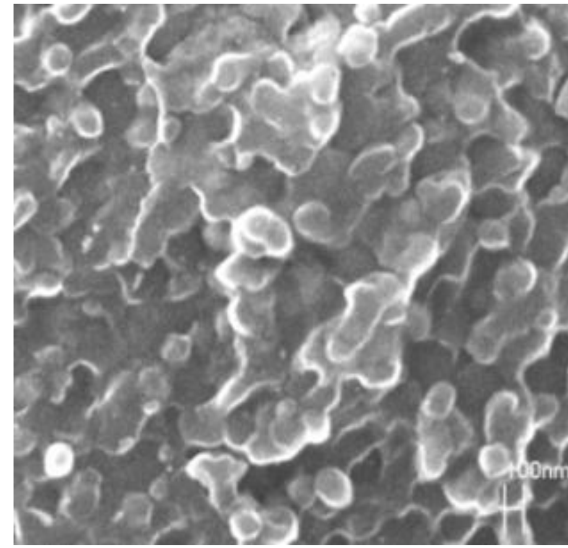
Introduction & Motivation

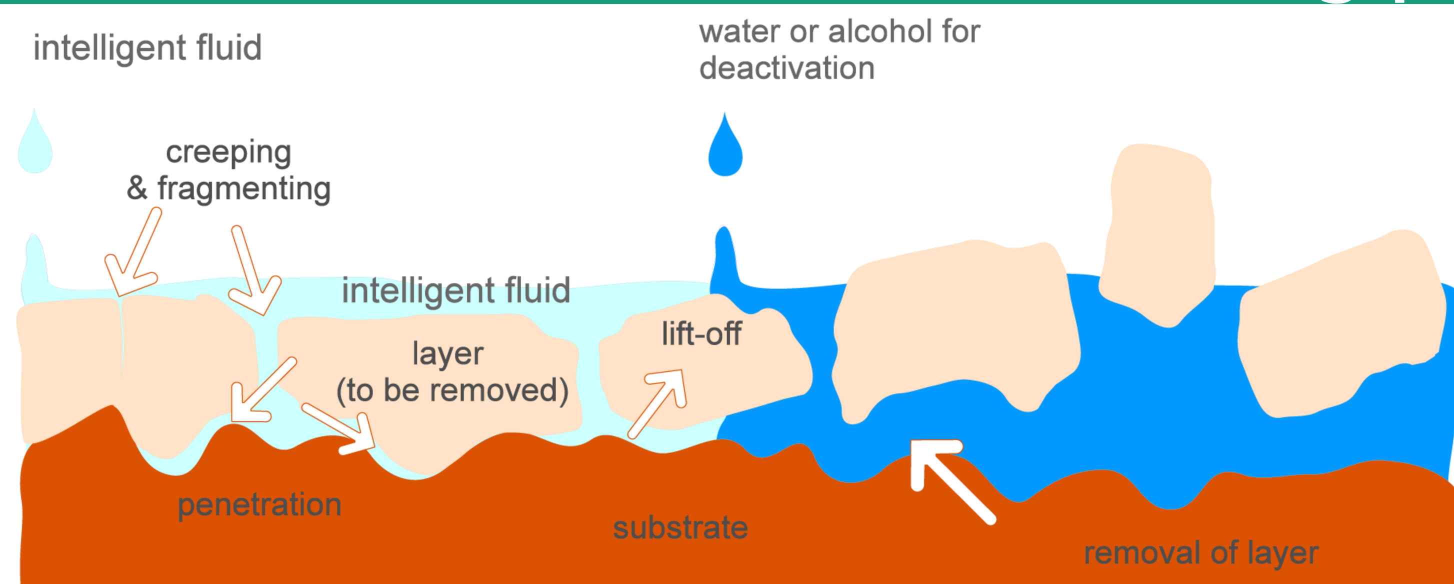
- Phase fluids are liquid-liquid-based complex fluids built up from dynamic and flexible plasmicells
- They are penetrating layers through smallest openings and lift off the material
- In use already in commercial cleaning and printing industry
- High potential for application in semiconductor processes
  - Resist removal, post etch cleans
  - Parts and equipment cleaning
  - Metall lift off processes



Freeze fracture of phase fluid with globular plasmicells

Applied already in commercial cleaning and printing industry

Working principle of phase fluids



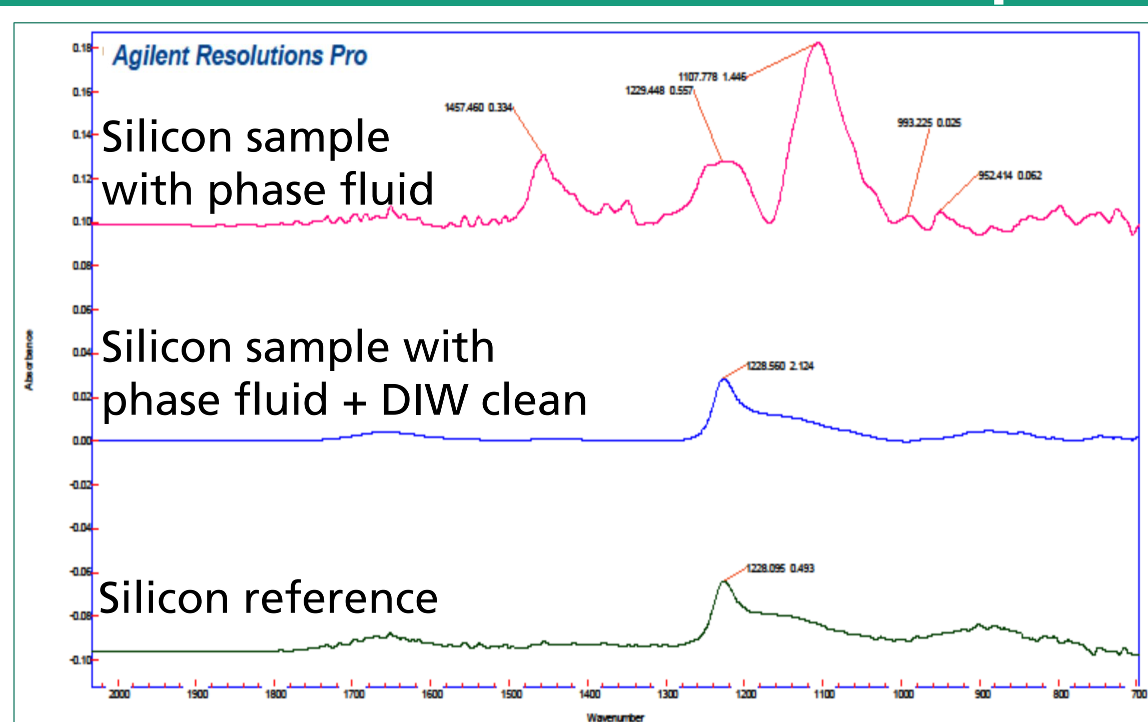
- Application of intelligent fluid in bath or spin on processes
- Temperature, time according to cleaning task
- Distribution and penetration through smallest openings due to dynamic plasmicells
- Lift off of resist material
- Inactivation of process by addition of DI water or Isopropanol
- Addition of subsequent process steps possible

Application example - resist removal

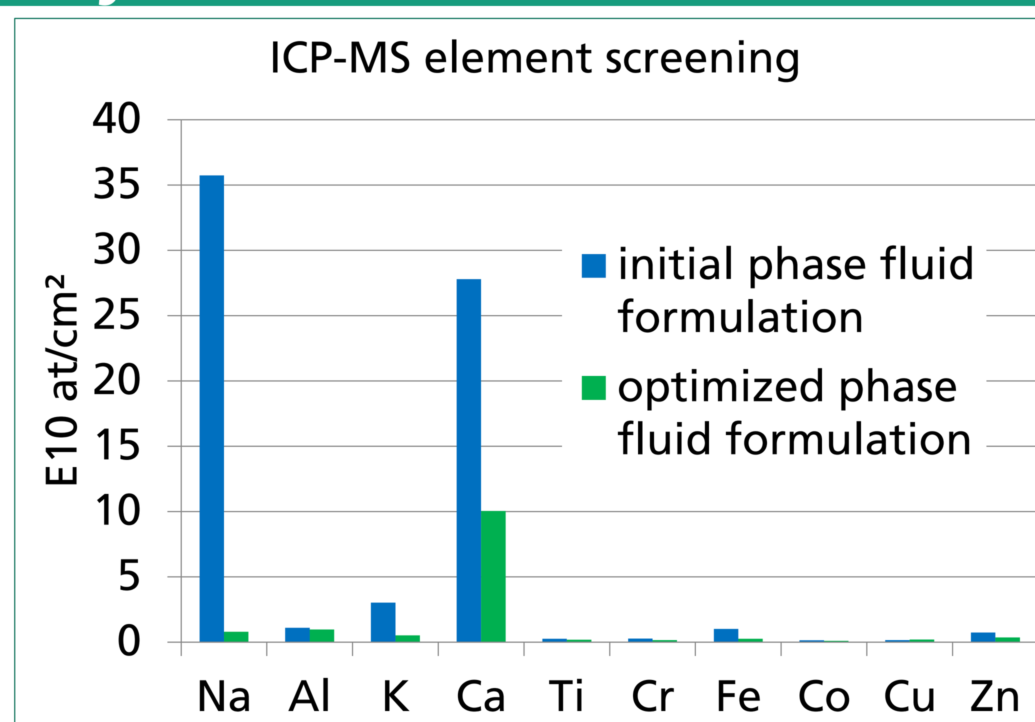
- Experimental Setup:
  - Silicon wafers resist coated on Brewer LabCoater, softbake 130°C 5min, wide band UV exposure, cleaved into samples
  - Cleaning runs done with phase fluid at 20°C..50°C, time <5min
  - Conventional solvent cleaning runs at 60°C, time 10..30min for reference
- Advantages of phase fluid based cleaning
  - Physical mode of action instead of dissolving
  - Environmental friendly
  - Neutral pH range, NMP free
  - Biodegradable, no aggressive ingredients

	AZP4620 18µm	AZ125nXT 12µm	THB151N 48µm
before cleaning			
after phase fluid clean			
after conventional solvent clean			

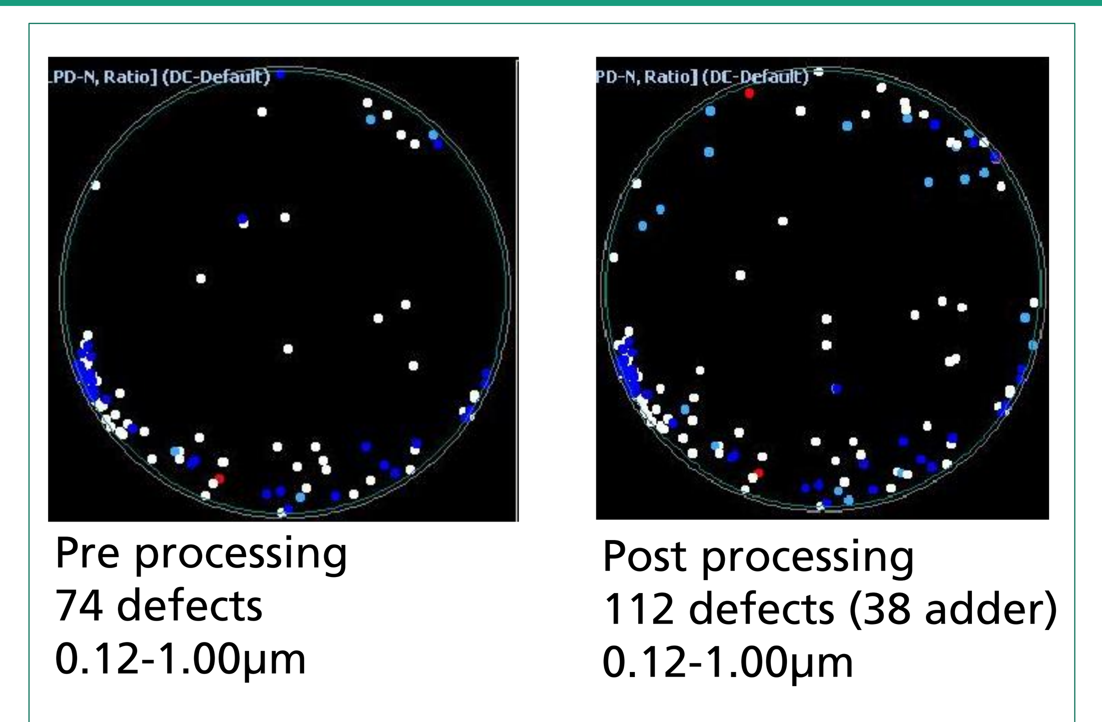
Compatibility to semiconductor environment



- Silicon samples prepared with phase fluid
- Samples rinsed with DI water
- FTIR characterisation with ATR contact mode on Agilent 5500 Series



- Phase fluids applied on 300mm Si wafers with spin process
- DI rinse and spin dry
- Elemental analysis of surface residues with ICP-MS



- Phase fluids applied on 300mm Si wafers with spin process
- Post clean with DIW and short diluted cold SC1 on DNS FC3000 wet bench
- Particle measurement on KLA Tencor SP2

Summary and Conclusion

- Proof of concept confirmed for phase fluid based cleaning in semiconductor processing applications
- Excellent resist removal efficiency leads to processing times <5min even for thick photoresists
- Phase fluid based cleaning offers a new working principle for cleaning applications
- Compatibility to semiconductor environment achieved by application of DI water rinse processes and additional SC1 cleaning if necessary
- Tailoring of intelligent fluids possible for customized cleaning tasks
- Outlook: implementation in existing processes, evaluation of challenging cleaning tasks (e.g. implant resists)
- Demo runs possible at Fraunhofer CNT, Dresden

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