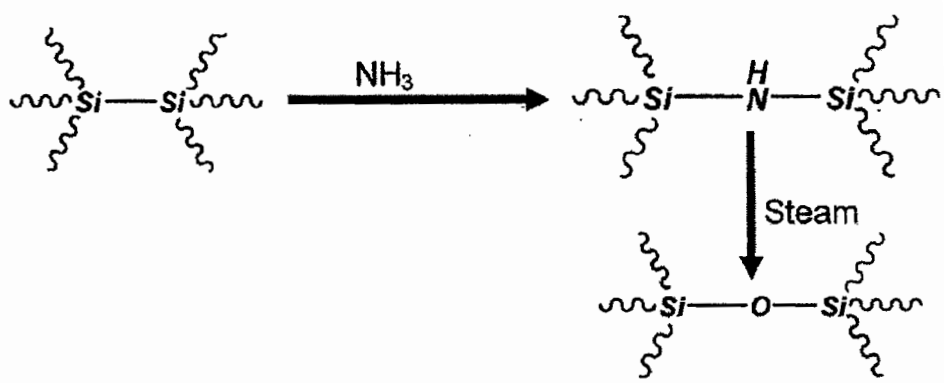


FIG. 1

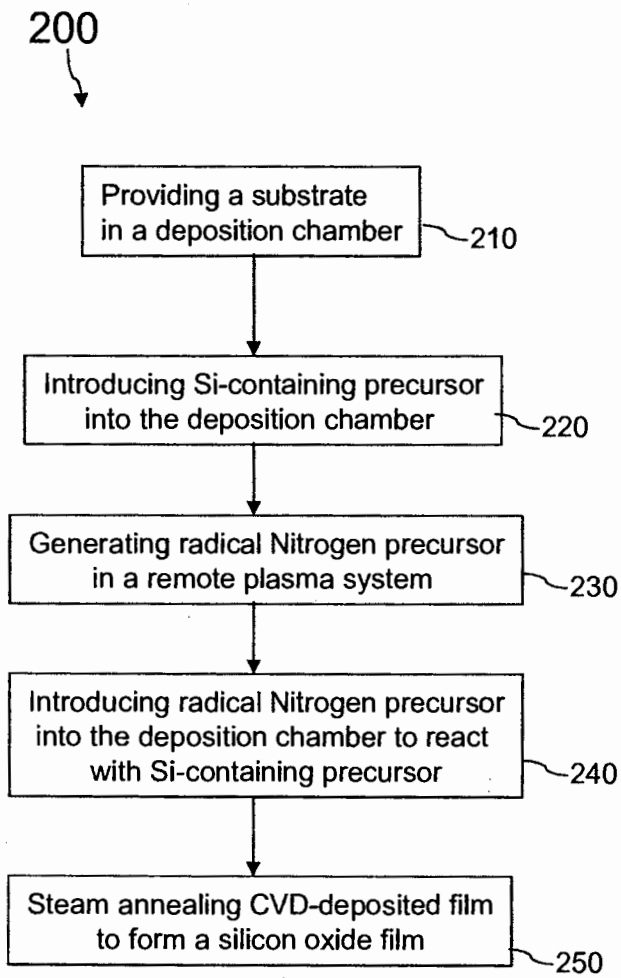

200
Providing a substrate in a deposition chamber
210
Introducing Si-containing precursor into the deposition chamber
220
Generating radical Nitrogen precursor in a remote plasma system
230
Introducing radical Nitrogen precursor into the deposition chamber to react with Si-containing precursor
240
Steam annealing CVD-deposited film to form a silicon oxide film
250

FIG. 2

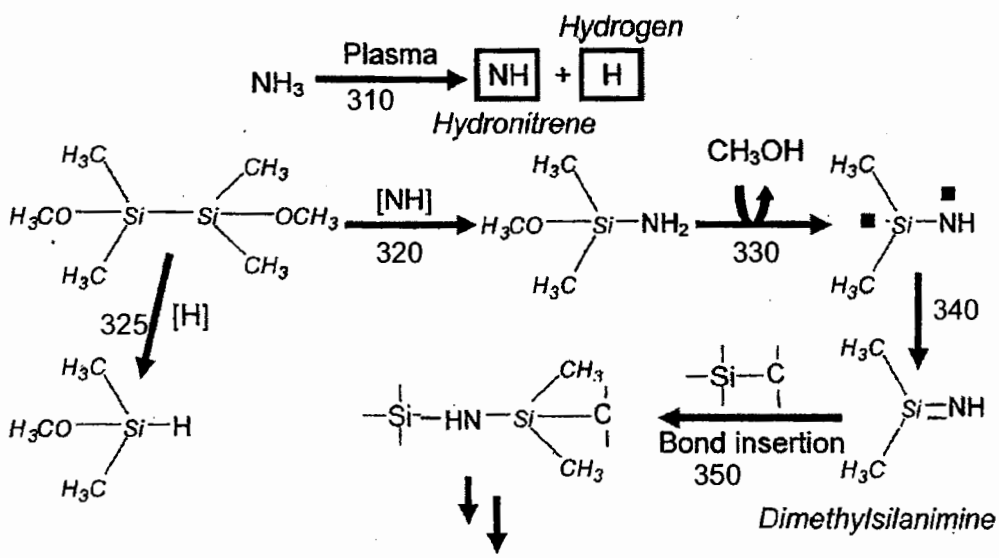

Hydrogen
Plasma
NH3
310
NH
+
H
Hydronitrene
CH3OH
[NH]
320
330
325
[H]
340
Bond insertion
350
Dimethylsilanimine
Amorphous Si:C:N:H

FIG. 3

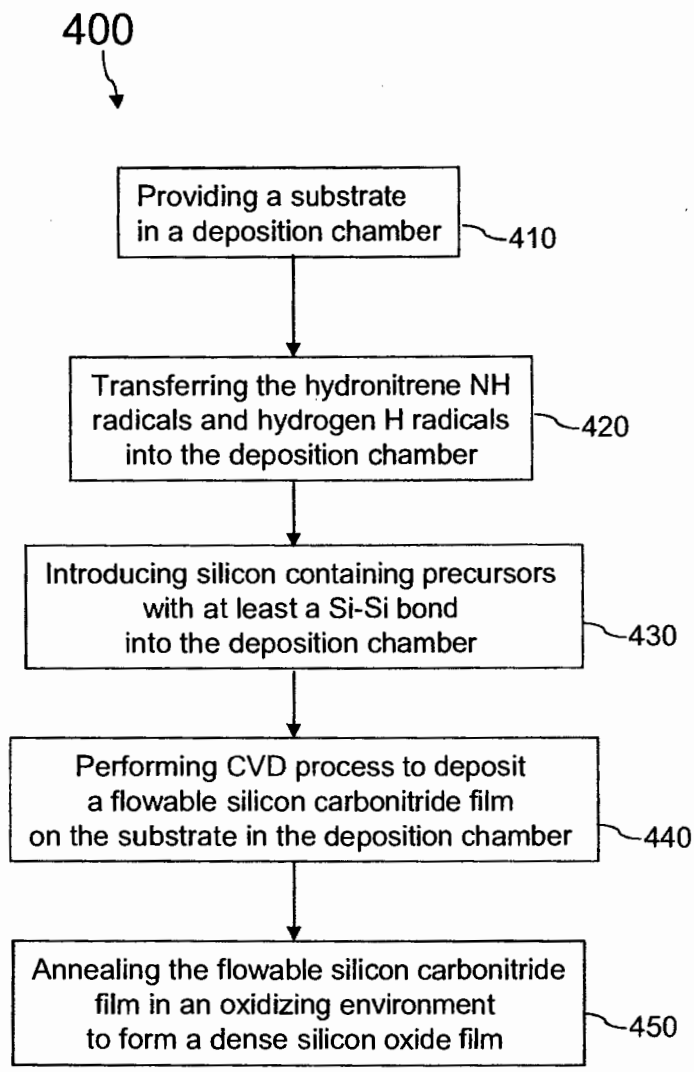

400
Providing a substrate in a deposition chamber
410
Transferring the hydronitrene NH radicals and hydrogen H radicals into the deposition chamber
420
Introducing silicon containing precursors with at least a Si-Si bond into the deposition chamber
430
Performing CVD process to deposit a flowable silicon carbonitride film on the substrate in the deposition chamber
440
Annealing the flowable silicon carbonitride film in an oxidizing environment to form a dense silicon oxide film
450

FIG. 4

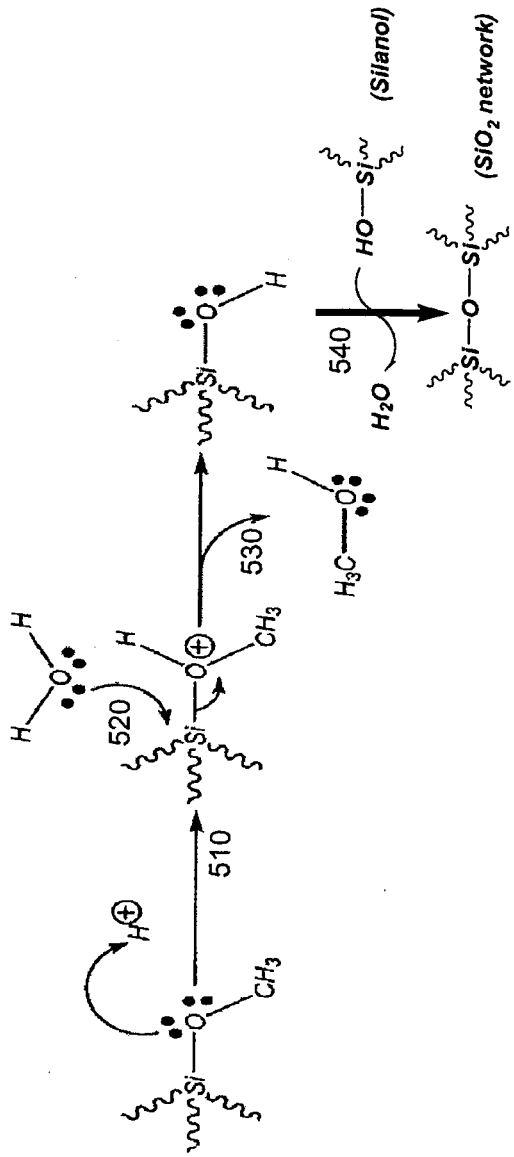


FIG. 5

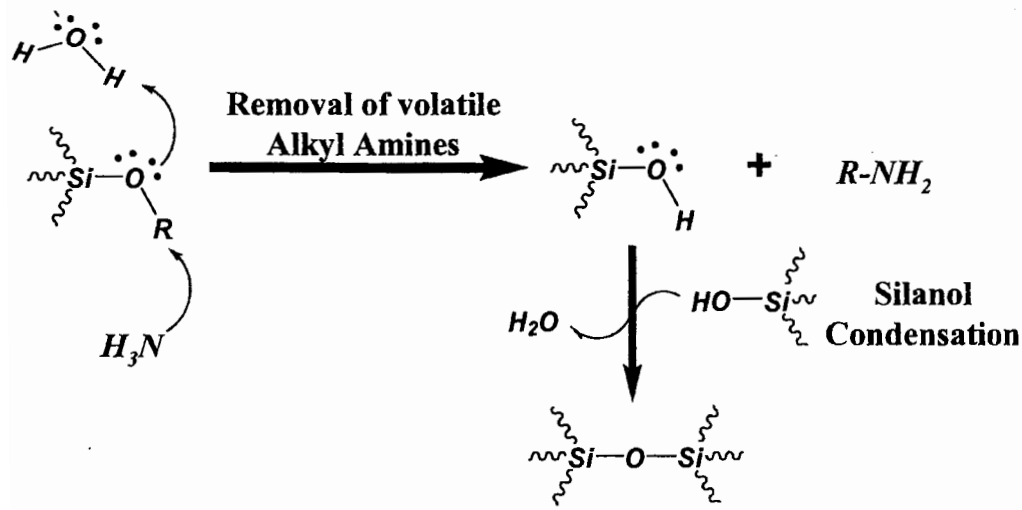

Removal of volatile
Alkyl Amines
R-NH2
H2O
HO—Si
Silanol
Condensation
Si—O—Si

FIG. 6A

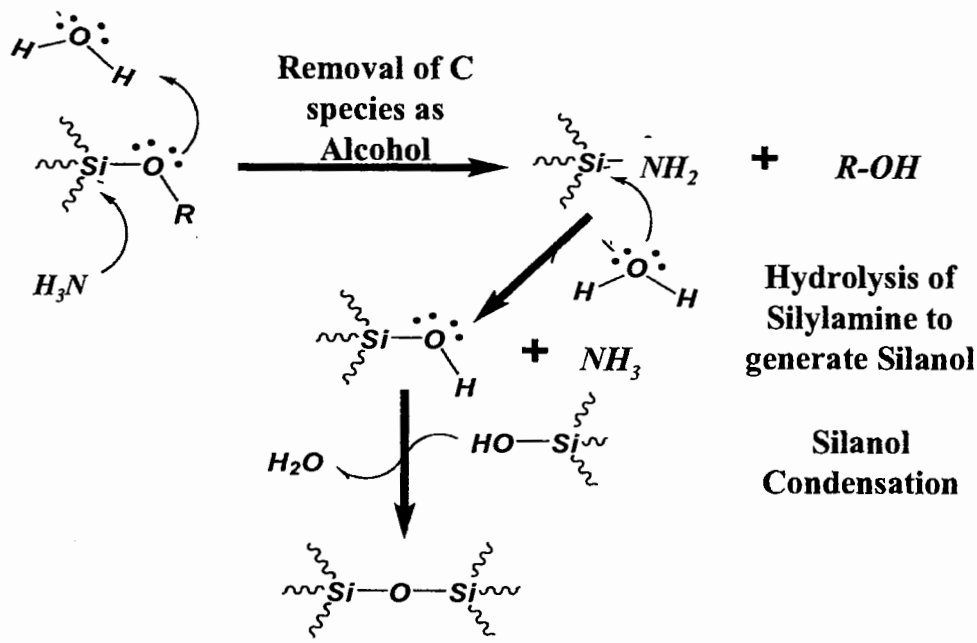

Removal of C species as Alcohol
R-OH
Hydrolysis of Silylamine to generate Silanol
Silanol Condensation

FIG. 6B

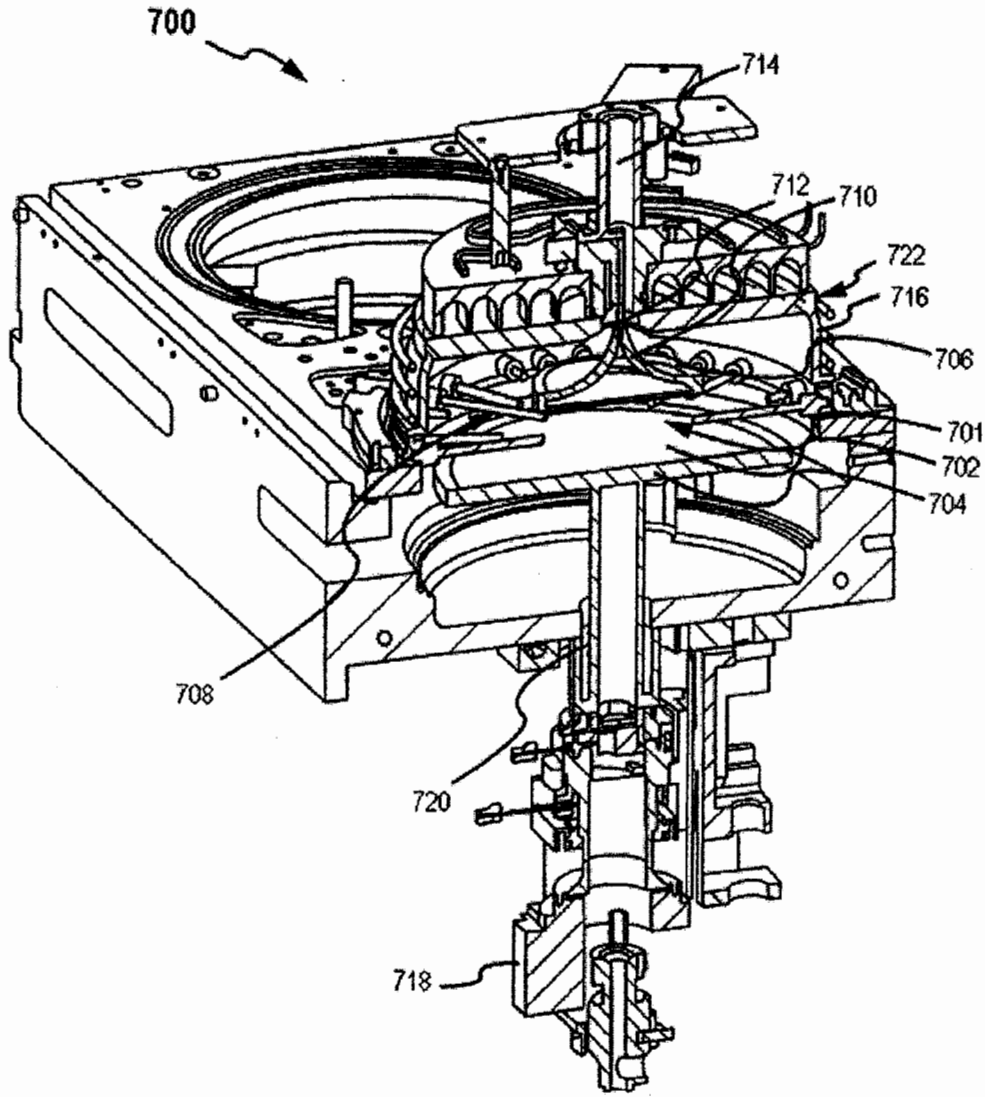


FIG. 7