

ABSTRACT OF THE DISCLOSURE

Selectively Removing Titanium Nitride Hard Mask and Etch Residue Removal

Formulations for stripping titanium nitride hard mask and removing titanium nitride
5 etch residue comprise an amine salt buffer, a non-ambient oxidizer, and the remaining
being liquid carrier includes water and non-water liquid carrier selected from the group
consisting of dimethyl sulfone, lactic acid, glycol, and a polar aprotic solvent including but
not limited to sulfolanes, sulfoxides, nitriles, formamides and pyrrolidones.. The
formulations have a pH <4, preferably < 3, more preferably < 2.5. The aqueous
10 formulations having water as liquid carrier and semi-aqueous formulation having water
and non-polar aprotic solvent(s) further contain acidic fluoride. The formulations offer
high titanium nitride etch rates while provide excellent compatibility towards W, AlN, AlO,
and low k dielectric materials. The formulations may comprise weakly coordinating
anions, corrosion inhibitors, and surfactants. Systems and processes use the
15 formulations for stripping titanium nitride hard mask and removing titanium nitride etch
residue.