Plasma Etch Chemistries for materials systems with Giant (GMR) and Colossal (CMR) Magneto Resistance

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Etching of NiFe

Chemistry	Typical Etch Rates Å/min	Corrosive	Comments
Cl_2/Ar	600 ICP > 1000 ECR	Yes.	Chemical enhancement of 100 %. Etch rate with Xe > Ar > He
CO/NH_3	250 ICP 500 ECR	No.	Chemical enhancement of 20% to 40%. CO_2 less effective than CO
CH_4/H_2/Ar	< 100	No.	Slower than Ar sputtering.
SF_6/Ar	< 100	No.	Slower than Ar sputtering.
BI_3/Ar	500	Yes.	Less effective than Cl_2/Ar
BBr_3/Ar	200	Yes.	Slower than Ar sputtering.
ICl/Ar	500	Yes.	Excellent surface morphology.
IBr/Ar	500	Yes.	Excellent surface morphology.

Etching of NiMnSb

Chemistry	Typical Etch Rates Å/min	Corrosive	Comments
SF_6/Ar	500 for $LaCaMnO_3$	No.	No chemical enhancement.
CH_4/H_2/Ar	200 for $LaCaMnO_3$	No.	No chemical enhancement.
Cl_2/Ar	1500 for $LaCaMnO_3$ 900 for $LaSrMnO_3$ 300 for $PrBaCaMnO_3$	Yes.	Physically dominated under all conditions for all three materials.
BI_3/Ar	500 for $LaCaMnO_3$	Yes.	Etch yield < 0.1 Threshold ion energy < 100 eV
BBr_3/Ar	500 for $LaCaMnO_3$	Yes.	Etch yield < 0.1 Threshold ion energy < 100 eV

Etching of CMR materials

Chemistry	Typical Etch Rates Å/min	Corrosive	Comments
SF_6/Ar	> 10000	No.	Selectivity ≥20 over Al_2O_3
NF_3/Ar	300	No.	Narrow process window.
Cl_2/Ar	3000	Yes.	Selectivity ≥ 5 over Al_2O_3
BCl_3/Ar	5000	Yes.	Selectivity ≥ 5 over Al_2O_3. Attacks native oxide.
ICl/Ar	1500	Yes.	Threshold ion energy 120 eV.
IBr/Ar	1500	Yes.	Threshold ion energy 230 eV.