MANCHESTER
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The University of Manchester

INDUCTIVELY COUPLED PLASMA-REACTIVE ION ETCHER CHAMBER (ICP RIE)

Inductively coupled plasma reactive ion etching (ICP RIE) is a technique that can be used to etch a variety of materials through creating a mix of reactive radicals and ions from gaseous precursors. These react on the surface of the substrate to selectively etch target materials. The use of ICP can reduce or eliminate the use of RF, which leads to more chemical selectivity, less side wall damage and less localized heating.

With the addition of RF possible we are able to maintain good side wall geometry from the isotropic nature of the etching. By tuning the recipes utilizing both of these electrodes can give great scope to a variety of etch profiles. BOSCH deep silicon etching is also available on both systems, but the Cobra is especially suited with faster switching speeds to reduce scalloping of the well profile for deeper etches. With a low base pressure (high vacuum) and a variety of source gases, plasma treatments can be carried out for a variety of functionalisation processes to occur to substrates.

We run a wide range of etches in the chamber using a combination of the gases available. Such etches include metallic mask etching to mesa formation for side wall electron injection. With deep Si etching as well, we have the capabilities of etching through a whole wafer with great control over the side wall, with limited scalloping.
By having low frequency etching available the degree of undercut when transitioning from materials of different etch rates is reduced, leading to better profiles of etch wells. The use of the end point detection allows for reduction of over etching when doing large area etches on substrates for fine features. With He backing the temperature of the sample can be kept constant and cooling cycles for more problematic etches can be implemented. All of these features allows for an overall well defined etch profile.

Gases available Ar BCl_3 Cl_2 CHF_3 He H_2 N_2 C_4F_8 O_2 SF_6 CF_4

Table temperature of from 0 to 40°C

Current etches supported but not limited to SiN, Si, deep Si, BN, mica, graphene, SiO

Sample size from fragments of wafer to 6 inch wafers

Inductivity coupled plasma power max 3000 W

LF RF power max

HF RF power max 600 W

Pressure max 100mTorr

Base pressure2 x 10 -7

Low pressure strike capabilities

Automated sample loading and unloading through load lock

He backing for sample for best thermal contact in vacuum environment

Capture of all parameters every up to every 2 seconds

End point detection for large scale etching

BOSCH MFC integrated into main body for fast switching 0.2 second (BOSCH specific system)

CMOS compatible (BOSCH specific system)