# Workshop 1: Plasmas in Multiphase media

Collated feedback from breakout sessions

- How does the plasma contribute to enhanced interaction between species in multiphase media?

- role of synergistic processes of neutrals & electric fields etc significant influence on interfacial processes?

- enhanced charging of isolated surfaces changing local chemistry; bond breaking, new species, radicals - ion bombardment. How is charge bound to the surface? What processes affect this, and what lifetime?
- reactivity often changed but not understood, e.g. formation of H2O2 can be much higher in charged droplets.
- in liquid polarizability can be more important than dielectric behaviour.
- plasma provides reactive species, the plasma might generate a gas in a liquid which leads to turbulence enhanced surface area.

- Plasma could potentially aid in biological research concerning biofilms (e.g. dealing with antibiotic-resistant bacteria) and cancer research (e.g. tumor drug delivery). Plasma can also provide a different (often better!) delivery of energy to the system, although there is an issue of selectivity.
- It forms particular structures that can't otherwise be formed in other systems.
- - Surface electric field can enhance interactions in all phases.
- - Synergies between particles, fields, coming from plasma into solid.
- - Is there the concept of an electron distribution function in a liquid?
- - How many phases should we consider at one time? Controlled by physical width of transition region? Need to consider collisional length scales within transition region?

- **What investigations can help identify and optimise the relevant processes?**
- The aerosol/colloidal chemistry community has a plethora of techniques and studies that may influence the direction of multiphase media studies with plasmas.
- Diagnostics for penetration depths and charging are realistic goals for the intermediate future.
- find out what the basic processes are for charge attachment and lifetimes - theory and experiment. Cross-section experiment.
- Need enhances source data (eg rate coeffts), covering regimes of interest;
- Atypical chemical pathways - enhanced spectroscopic investigation?

- Collaboration with femtosecond lasers labs to resolve species crossing a boundary. (eg bubbles)
- modellers to collaborate with diagnostics experts to define desirable measurements
- do we have a robust repeatable plasma (benchmark)? We don't have benchmark models in much of plasma physics let alone multiphase physics to compare models to expt.
- Is there a proxy measurement, e.g. impedance that tells us something about the multiphase such as bubbles forming.

- These should be application-driven – perhaps create a priority list of the fundamental data we need (probably tied to specific application). Need data for modelling e.g. cross-sections, rate coefficients and to know regions of applicability, etc.

- - There are procedures for liquids but no in interface with plasmas – so not fully valid here.
  - New diagnostic methods are required.

- What other relevant points should be made?
- A coherent model (or several) for charging of multiphase media would be desirable and ablation of metals by lasers: do these count as multiphase media?
- laser-surface interactions are a particular aspect. Reach out to other communities with different languages/terminology, but same underlying science principles