Efficient exploitation of shale gas reservoirs requires several key areas of understanding; how gas is stored within the shale, total gas in place, estimated ultimate recovery and how much gas remains in the reservoir. These assessments are currently less than perfectly constrained, inhibiting optimization of field development (e.g. well spacing) and leading to increased economic risk for the development of shale plays.

At Imperial College London we have developed a custom-built shale desorption cell into which powders or plugs of representative samples of shale reservoirs can be loaded. Known volumes and compositions (molecular weight distribution and stable carbon isotopic compositions) of gas can be introduced and adsorbed onto the shale “micro-reservoir”. Depressurization of the shale desorption cell is analogous to production of the larger scale shale gas reservoir.

Measurement of the gas recovered from the shale desorption cell is performed using coupled online gas chromatography – flame ionising detector (GC-FID) and online gas chromatography – isotope ratio mass spectrometry (GC-C-IRMS) systems to study molecular weight and stable carbon isotopic fractionation respectively. The fractionation of molecular weights (small vs large hydrocarbons) and stable carbon isotope ratios (light vs heavy carbon) measurable in the gas are dramatic and reflect the stage of depletion of the shale desorption cell. Analogous gas geochemistry signatures are expected for producing shale gas reservoirs.
Comparing laboratory data with real production data for shale gas wells will enable effective monitoring and prediction of production behaviour.

The gas geochemistry technique unconventional gas plays can be optimized in terms of economic analysis, risk mitigation and well lifecycle forecasting. The online shale desorption cell-gas chromatography-flame ionization detector and shale desorption cell-gas chromatography-combustion-isotope ratio mass spectrometry systems are globally unique systems recently developed in the Organic Geochemistry Laboratories at Imperial College London.

![Sample Cell](Sample Cell) ![GC IRMS](GC IRMS)

Figure 1. The world’s only online shale desorption cell-gas chromatography-combustion-isotope ratio mass spectrometry system at Imperial College London (left panel) and decline curve estimates for a number of shale wells (right panel). The shale desorption system will allow more accurate estimates of estimated ultimate recovery and decline curve positioning.

The research will use equipment in the Imperial College Organic Geochemistry Laboratories (right). Full training will be provided. The project would suit a candidate with enthusiasm for petroleum geochemistry and a background in Earth Science, Chemistry or a subject that develops similar skills.

Contact: Professor Mark Sephton (m.a.sephton@imperial.ac.uk) for more information. Details of how to apply can be found at: [http://www.imperial.ac.uk/study/pg/apply/how-to-apply/](http://www.imperial.ac.uk/study/pg/apply/how-to-apply/)