Application Note: 001
Issue: 2

Sample deposition on Klarite SERS substrates.

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Key Words

- Surface enhanced Raman
- Sample deposition
- Thin film-Mapping
- Amino Aciids
- Alanine

How to use Klarite substrates

Mesophotonics Klarite® substrates provide a unique solution for Surface Enhanced Raman Spectroscopy (SERS). The very high signal levels achieved when using Klarite significantly reduce the detection limits for many molecules. The uniformity of the enhancement across the chip also enables spatial and compositional mapping of the sample over the surface or quantitative analysis without requiring high laser power. This makes SERS extremely attractive for fast and cost effective sample analysis for many applications.

To achieve the maximum benefit from using Klarite, samples should be deposited onto the active surface and analysed with a standard Raman instrument. Many sample deposition techniques are possible ranging from dip coating to multi array spotting. A pipette dropping method is described here for basic analysis, although other techniques may be better suited to your applications.

For illustration purposes the amino acid L-Alanine is used as an example throughout this note. However, the methodology described here can be applied to many other compounds and solvent.

Preparation of the sample on the Klarite substrate is done in the three steps described below.

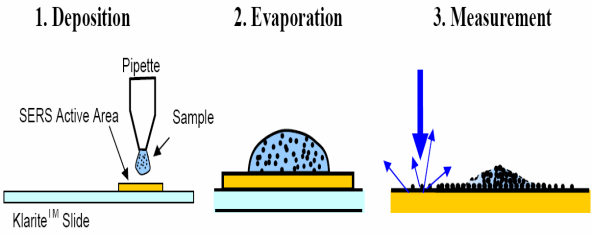

Figure 1: Standard Klarite deposition

Equipment.

- Pack of Klarite SERS device code 302 mounted or 303 unmounted
- Micropipette
- L-Alanine (Sigma-Aldrich A7469)
- ultra filtered water (Sigma-Aldrich 95289)
- Raman spectroscopy instrument (for suppliers see www.mesophotonics.com)

1. Deposition

Using a pipette, a liquid sample of typically 4µM or less is deposited onto the active area of the Klarite chip highlighted in Figure 2. If the drop does not detach from the pipette, carefully let the drop touch the substrate and then transfer the drop onto the substrate.

Avoid touching the chip with the tip of the pipette – a scratch to the gold surface on the chip will adversely affect the measurement results.

The solution used in this sample was obtained by diluting 7.5mg of L-Alanine (Sigma-Aldrich A7469) in 15ml of ultra filtered water (Sigma-Aldrich 95289).

2. Evaporation

In general the evaporation process of any liquid on a surface produces one of three main types of patches: coffee rings [1,2] crystalline capillaries or spot-like stains. The evaporation result depends on the interplay of adhesive forces of the substrate and cohesive forces of the fluid.

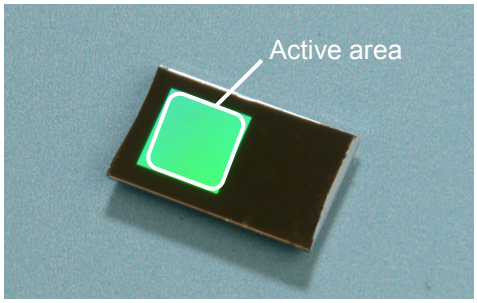

Figure 2: SERS active area on Klarite onto which sample should be deposited

The L-Alanine used in this example was left at room temperature in a clean lab environment for about 30 minutes for the water solvent to evaporate. Typically the evapourated L-Alanine will appear as shown in Figure 3.

3. Measurement

Once the sample is dry, Raman measurement can be carried out across the deposited patch. The patch will appear formed by many concentric rings of different colours.

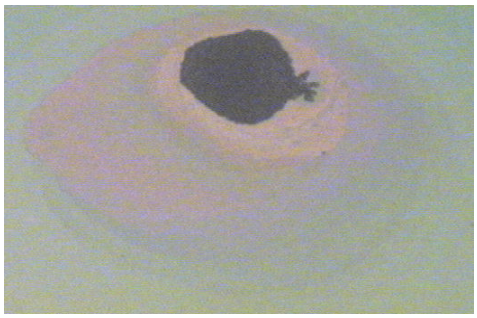

Figure 3: Evaporated drop of a 5mM L-Alanine on Klarite recorded with a 5x microscope objective.

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Crystalline islands can also form inside the patch for concentration typically >1mM. In general the size and characteristics of the film patch and crystalline islands depend on the concentration of the solution, the purity of the solvent and the polar nature of both the analytes and the solution.

Typical Raman spectra of L-Alanine across the film patch are shown in Figure 4. The spectra were acquired in 10 sec of CCD exposure time with 15mW laser power at 785nm excitation with a standard micro Raman instrument. No normalisation and baseline subtraction was performed on the spectra. Quantitative data on film composition and molecular interaction can be obtained by probing the Raman features across the patch.

Summary

This application note provides an example of a basic sample deposition technique and the Raman spectra that can be obtained from different deposited regions.

Man other deposition and analysis techniques are possible with Klarite. These include full mapping of the surface, uniform layer deposition and multiarray spotting. The gold surface on Klarite is also compatible with a large range of solvents. For details of these techniques and additional application relevant sample tests please see the additional application notes available from www.mesophotonoics.com

References

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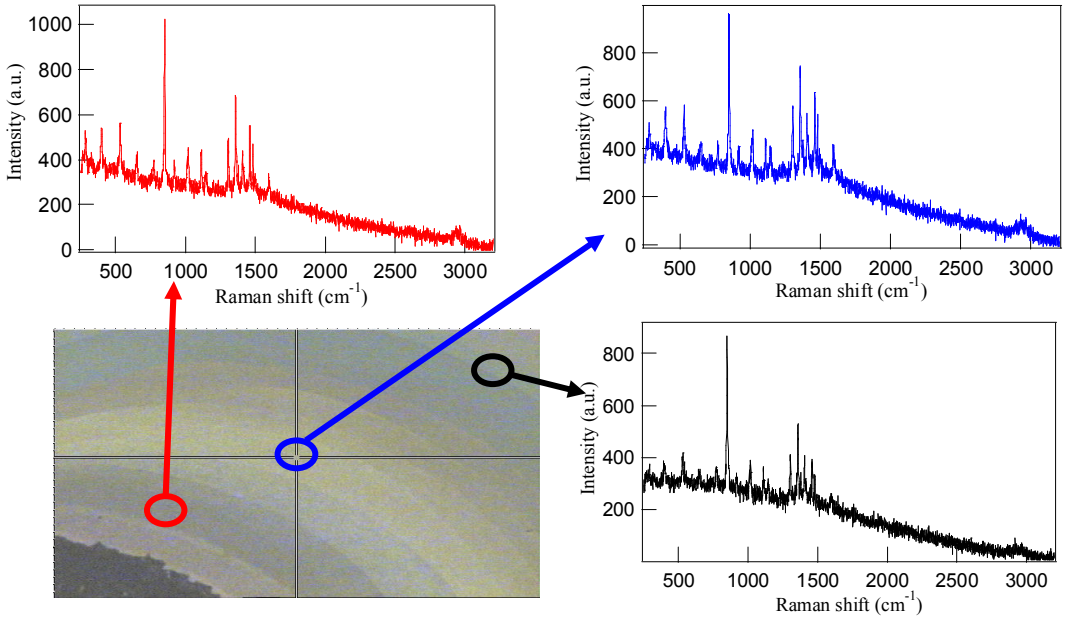

Figure 4: SERS spectra acquired on L-Alanine dried film (56.1 mM) deposited on Klarite with recorded with

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