Low Cost Nano Imprint for Surface Enhanced Raman Scattering

Blessing Adewumi[a)]*, Debsmita Biswas, and Martin Feldman*

Louisiana State University, Baton Rouge LA, USA

and

Li Jiang and Naga Korivi

Tuskegee University, Tuskegee, AL, USA

[a)] Electronic mail: badewu1@lsu.edu

In Raman Spectroscopy monochromatic light scatters inelastically from targeted molecules. The resulting wavelength changes serve as identifying "fingerprints" of the molecules. In Surface Enhanced Raman Scattering (SERS) nano-metallic surfaces in contact with the molecules enormously enhance the spectroscopic signal. In this work a laser beam at 650 nm wavelength was focused by a lens onto a SERS layer in contact with a suspension of Rhodamine 6G (R6G) dye (Fig 1). The SERS layer was constructed by using fine grit (1µm) sandpaper as a template for imprinting nano-patterns on a PETE-1 thermoplastic substrate. Therefore, costly nano lithographic processing was avoided. A pressure of 500 MPa in a 90^{o}C oven for 12 minutes produced nano-scale imprints in the plastic which were filled by 50 nm long silver rods from a commercially available ink used for jet printers (Fig. 2). Strong Raman spectra were obtained with a 1 milli mol. suspension of the R6G (Fig 3). The signal strength decreased linearly at reduced concentrations in logarithmic scale, as expected for SERS, down to 1 nano mol. (Fig. 4). Raman signals were not detected on thermoplastic substrate without nano imprint. Signals were not obtained with substrates imprinted with coarse surface sandpaper (6 µm), suggesting that the Raman signals arose from the finer gaps between nanoparticle clusters in the 1µm grit imprint.

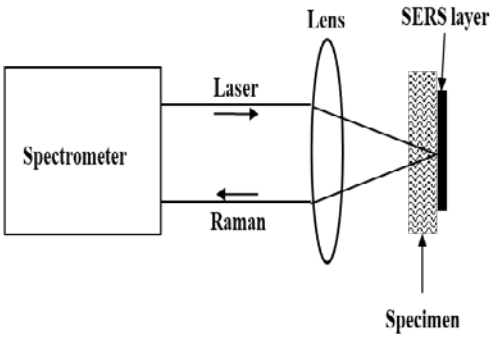

Fig. 1: Experimental setup

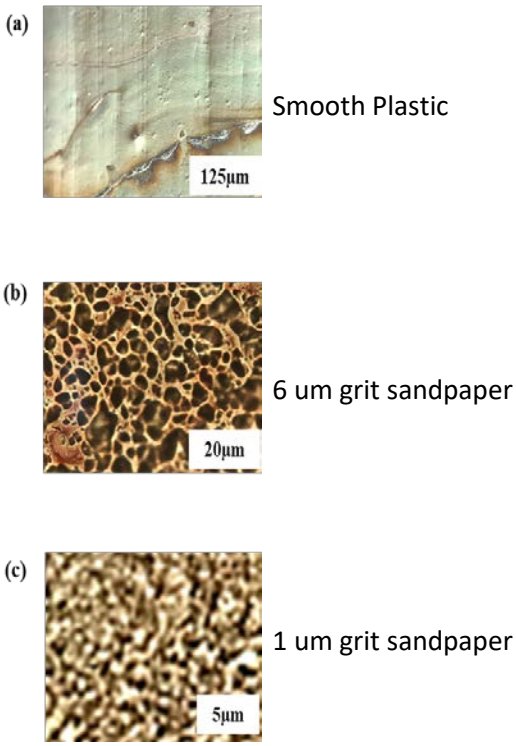

Fig. 2 Micrographs of deposited silver dye on various substrates

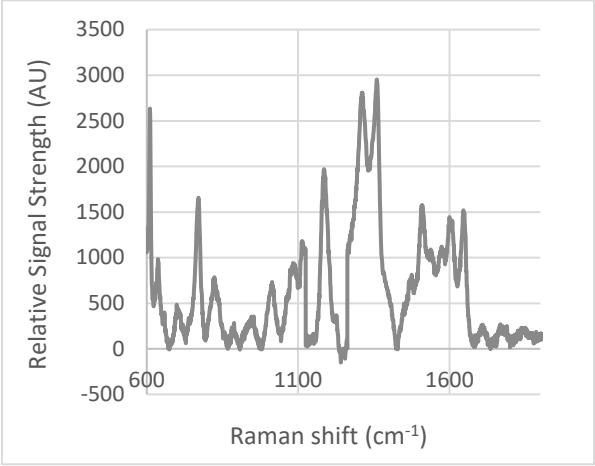

Fig. 3. Raman spectrum of 1 mM R6G

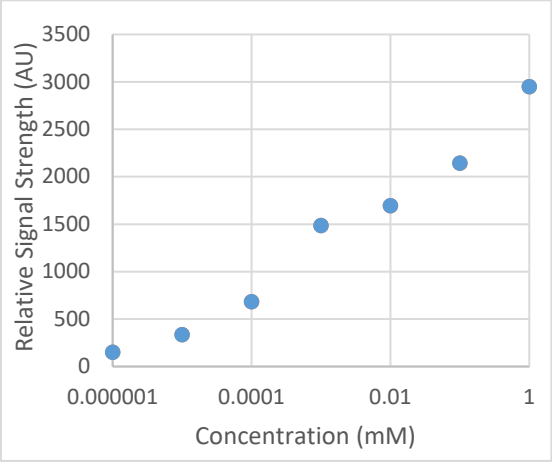

Fig 4. 1360cm^{-1} R6G Raman peak signal strength vs concentration of R6G (mM)